SCIENTIFIC AMERICAN

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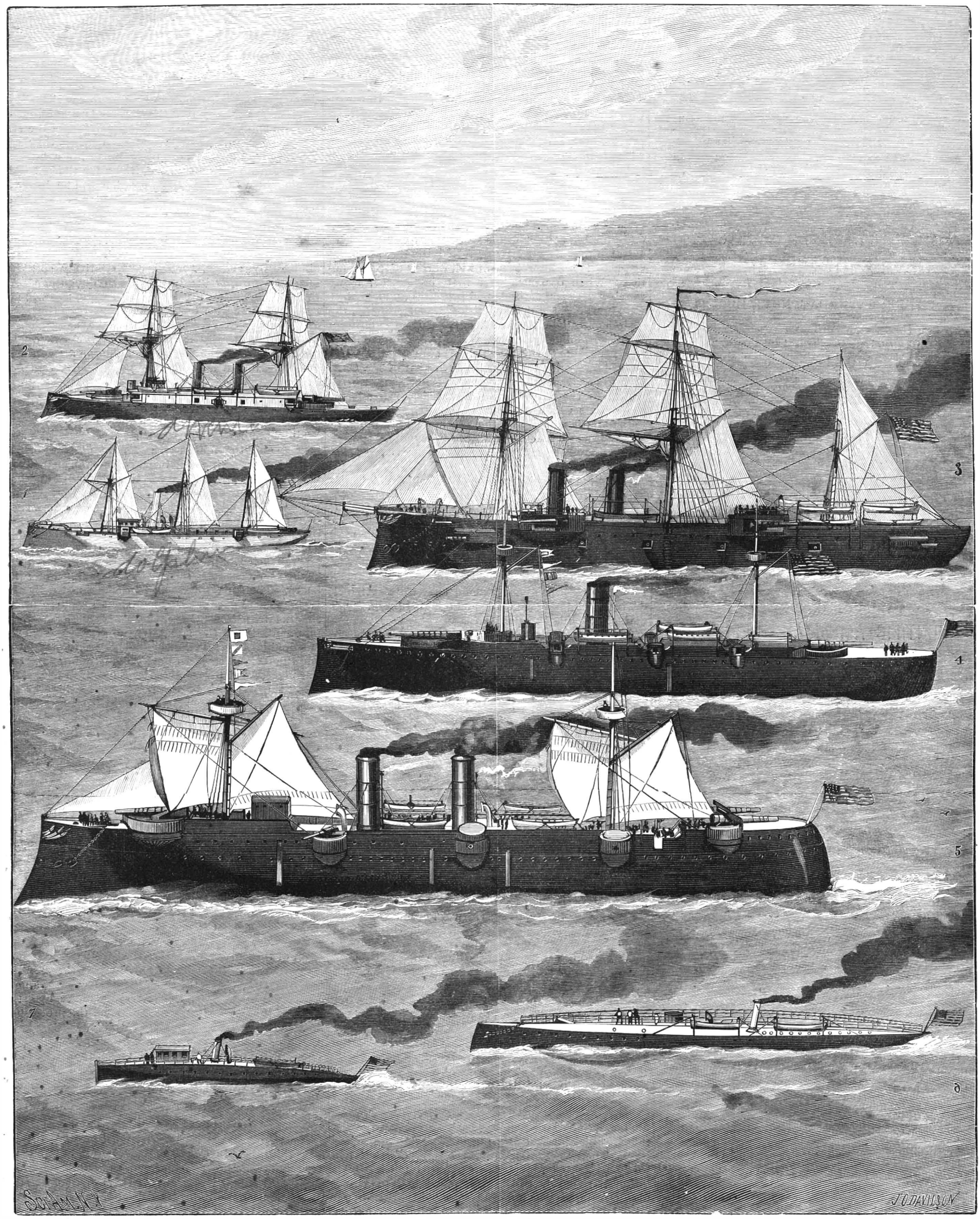

1. Dolphin—dispatch boat. 2. Atlanta—steel cruiser, sloop of war. 3. Chicago—steel cruiser, frigate of war. 4. Charleston—twin screw steel cruiser. 5. Baltimore—the largest steel cruiser. 6. Dynamite cruiser. 7. Torpedo boat Stiletto.

OUR NEW NAVY—TYPES OF VESSELS NOW FINISHED AND BUILDING.—[See page 324.]

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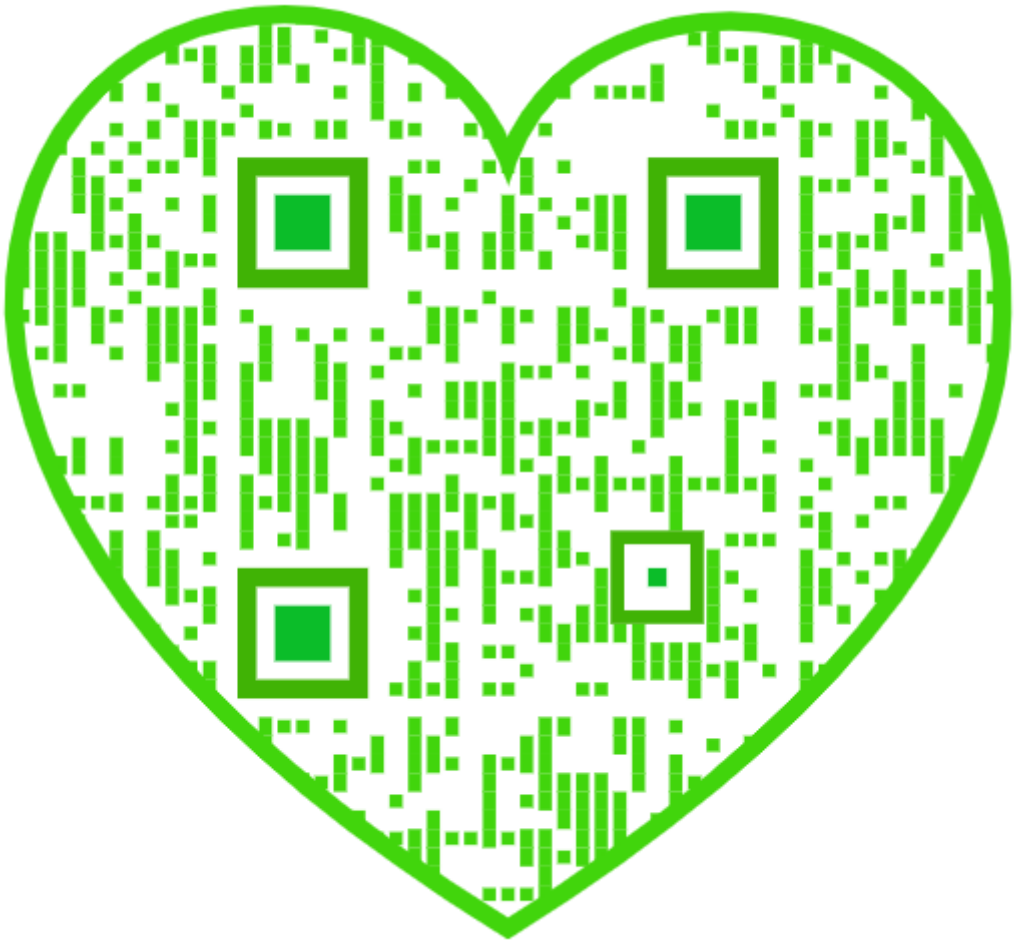

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INTERNATIONAL UNION FOR THE PROTECTION OF INDUSTRIAL PROPERTY.

We have received a pamphlet treating of the effects of this treaty, recently signed by the President, upon industrial property, patents, and trade marks of citizens of the United States. It is issued by the government and is written by Mr. F. A. Seely, Examiner of Trade Marks in the U. S. Patent Office. It presents the general history of the subject, and gives the provisions of the treaty, following each quotation with a discussion of its effects.

In the main there are no effects as far as American citizens or patentees are concerned. The provisions of our patent system are already so liberal, as compared with those of other countries, that a treaty of this sort does not operate to broaden their scope; while the limitations of our statutes are such as to remove the American patent practice practically from the operation of the convention.

The review by Mr. Seely is most creditably executed, and may be commended to our readers. In the future the treaty may develop so as to affect our interests. As periodical meetings of the commissioners are provided for, a continual discussion of its provisions, with modifications thereof from time to time, is a probability.

THE GENEVA NON-MAGNETIC WATCH.

In these days, when dynamos and electric motors are everywhere met with, and when they are continually finding new fields for work, the production of a watch that is utterly unaffected by the strongest magnets is an improvement well worthy of special notice. When dynamos were first introduced, many watches were magnetized, and processes and machines were invented for demagnetizing them. Finally, the custom of leaving the watch outside when entering a room containing dynamos was adopted, to prevent the annoyance due to this trouble. A cure for the whole affair, however, is found in the invention of Mr. C. A. Paillard, of Geneva, Switzerland. He has applied palladium to the manufacture of watches, using it for those parts which are usually constructed of steel. Palladium is a metal of the platinum group, but of far lower density than the latter; it is only of 11·3 sp. gr., or about 50 per cent heavier than steel. It melts at 2,480° Fah.

Palladium is absolutely non-polarizable, and is unaffected to any noticeable extent by the presence of a magnetic field. The invention was recently tested before the National Electric Light Association. A balance wheel made of it as a substitute for steel was placed directly upon a powerful magnet without showing the slightest adhesion; another was floated upon water, and was entirely indifferent to the presence of a horseshoe magnet held close to it. An incidental advantage is that the metal is rust-proof. This makes it peculiarly valuable for use at sea. Dynamos are now being introduced on many ships, so that in one of these non-magnetic watches the two great troubles of rust and polarization are successfully provided against.

The introduction of dynamos and motors for the propulsion of street cars, for elevators, and for scores of other uses is only a question of time. The importance of having a non-magnetic watch is increasing every day. The Geneva Non-Magnetic Watch Company, of 177 Broadway in this city, are well prepared to supply this want of the day, as they are the agents for Mr. Paillard's inventions, which have proved so successful and which on their face must solve the problem.

Alaska as a Mining Region.

From all we have been able to learn, the outlook for placer mining in the Territory of Alaska is not so very encouraging, the long distance these mines are located from the sea coast, the cost of getting to them and of living after they are reached, coupled with the shortness of the working season, constituting the great impediments to success in this branch of mining. The only placers that seem to amount to much are found on the upper Yukon; nor do these, so far as discoveries have gone, appear to be either rich or extensive. In proceeding to that region we have first the passage by steamer from San Francisco or other more northerly port to Sitka, a trip made in a few days and at small cost.

But Sitka reached, the real hardships begin, the journey thence on being rough, toilsome, and not altogether free from danger. It is also very expensive. After navigating an inlet for a hundred miles the miner reaches the Chillcoat mountains, where a long and costly portage has to be made, the Indians charging $13 per hundred pounds for packing goods over the range, which has an altitude of 3,500 feet above sea level. These mountains crossed, a series of lakes has to be navigated for another hundred miles, which brings the voyager to the Yukon, a large, swift-running stream, up which he has to pull his boat full 500 miles before reaching the first diggings. What of time, labor, and exposure such passage involves, one can readily imagine when told that the current of this river runs at the rate of five miles per hour.

If in that region the miner gets in 90 days of actual work, it as much as he can count upon. Yet this, between going and coming, implies a year spent about the business, unless the miner attempts hibernating in that high latitude, an alternative which few have the hardihood to try.

While getting to these mines is no mere pastime, the wages made there are by no means large—that is, if the accounts given by those who have lately returned from that region can be depended upon, and, according to which, the earnings of the miners do not average more than $300 or $400 for the season; or, to use the language of these men, they run from $200 to $500. The gold, which is scaly and rather fine, occurs in bars along the main river and some of its tributaries. These bars, none of which are rich and some of which are entirely barren, are for the most part small and difficult to work, the ground a few feet back from the water being frozen solid to bed rock.

The miners who returned recently from the Yukon diggings, Alaska, while agreeing as to the richness of the bars in gold, say that the country is a hard one to mine in and to prospect in. The shortness of the season is a great drawback, and even when they can work, the myriads of mosquitoes make life a burden.

These are not inviting conditions for the old California miner, few of whom we opine will be likely to seek these distant and forbidding regions as a field of labor, unless it be in search of quartz deposits, upon which, it seems probable, the mining industry of Alaska will have to mainly depend. That some portions of the country are rich in vein mines has been abundantly shown, though comparatively speaking but little prospecting has yet been done there. Although the winters are long and severe, this will not much interfere with quartz operations once the mines are opened and equipped with plant, as wood and water are generally in ample supply. As a quartz mining country, the resources of Alaska are certainly considerable and may be very great.—*Min. and Sci. Press.*

Closing Events of the Autumn Naval and Army Maneuvers at Newport, R. I.

The sham battle between the North Atlantic naval brigade and the military was fought at Newport, R. I., on November 10, and brought the fall maneuvers to a brilliant close. The naval brigade landed and had managed to pass the enemy's batteries at Fort Adams, but were unable to dislodge the opposing forces from their position on Coddington's Point. This compelled them to retreat to their boats and return to their ships. The fire from these protecting vessels was assumed to protect their landing and embarkation. Shortly after daybreak on the 10th, the reveille was sounded on shipboard. The squadron formed in column, led by the Richmond. Four torpedo boats went ahead to find a channel free from the enemy's obstructions. As a representative of the latter, ten mines were anchored in a double row across the channel between Fort Adams and the Dumplings. In Fort Adams a junction box was placed, which was under the umpire's eye. If a vessel ran over one of the mines, an igniter was exploded by contact. This indicated to the umpire which mine had done its work. Flags indicated a clear way through the mines where the torpedo boats were assumed to have countermined the defense. In passing the line of mines, the Ossipee exploded one of the igniters, and was declared out of action. Otherwise all the vessels passed through. They had also to stand in their passage a vigorous cannonading from the shore, but were all allowed a safe passage. They then anchored off Coddington's Point in readiness to shell the ground selected for the sham battle of the afternoon.

At noon the landing of the naval brigade began. The men were carried ashore in launches with three inch and Gatling guns. The marines took a prominent part in the contest, and the army was represented by both infantry and cavalry. The attack at last began. The tide of battle turned several times, but the shore forces prevailed over the blue jackets. Under cover of the ship's guns and of the Gatlings, the sailors at last took to their boats to return to the ships in orderly retreat. Just as this fire was slackened, a new attack was made upon the retreating forces by artillery and infantry. But, by a renewal of the protecting fire, the attacking body was repulsed. The sailors kept up a fire from the boats as long as their powder lasted. The squadron, after receiving its men, took up its old berth off Goat's Island; and with a fairly even distribution of victory on both sides, the autumn maneuvers closed.

Invention of the Circular Saw.

The circular saw has been claimed as an American invention, made by Captain William Kendall, in 1820. This claim is pretty effectually upset by the fact that an English patent was granted in 1777, to Samuel Miller, of Southampton, for an entirely new machine for sawing wood, stone, etc., in which the drawings show the circular saw. Now let the screaming eagles shut up on this subject. There are plenty of other inventions to brag about that really originated on this soil.

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PHOTOGRAPHIC NOTES.

The Hydrochinon Developer.—From a comprehensive history of the hydrochinon developer by Jex Bardwell, in the *Philadelphia Photographer*, we extract the following as an excellent formula:

No. 1.

Soda carbonate	60 grains.
Water	1 oz.

No. 2.

Hydrochinon	2 grains.
Soda sulphite	60 "
Water	1 oz.

For use mix—

No. 1	1 oz.
No. 2	2 "
Water	1 "

The above is a modification of a formula given by C. E. Van Sothern, in which he advises the use of 12 grains of hydrochinon to one ounce of water. It is usually advisable to employ a larger quantity than I have stated when it is found that the gelatine plate used gives a thin image. For line work negatives and transparencies the developer may be used over and over again and then be bottled for use as a starter on another batch of plates. Each successive exposure should be longer when the old developer is used.

Another excellent quality of hydrochinon is the beautiful tone of its deposit, a fine, velvety engraving black, and magnificent clearness in the shadows. I have never used a developer that pleased me better. It has also given me better tones and as pure whites on bromide paper as the regular oxalate developer. I have not tried it on negative paper or films, but I venture to say it will prove just as valuable.

The developer keeps well, the negatives are pure in color, and of any strength that you desire to make them.

It is advisable to develop without the use of bromide. If the plate is overexposed, simply commence with one-half or one-third the stated amount of No. 1. Carbonate of potash answers equally as well as soda.

A Safe Medium for Retouching Unvarnished Negatives.—Karl Klauser, in the *Phil. Photo.*, recommends the following: I produce the desired "matt" surface by crushing and powdering on a glass plate a small lump of resin, and adding to it about a third of its bulk of ashes of cigars or cigarettes. This addition will neutralize the too sticky quality of the resin. Put the mixture in a bag of old, well-washed muslin, daub the part to be retouched with it until a very small quantity of it settles on the negative, and finish by rubbing lightly with your finger over the desired part. A surprisingly small part of this dust will be sufficient to completely deaden the surface and render it fit for the pencil.

Kirchhoff and Spectrum Analysis.

Gustav Robert Kirchhoff, whose brilliant discovery of the significance of the shadows of the spectrum has done more for science than any other discovery of this century, died very suddenly a fortnight ago, although for some years back he has been in delicate health. Professor Kirchhoff was born at Konigsberg in 1824, and had, therefore, only reached his sixty-third year. It is now exactly forty years since he entered the University of Berlin as a *privat docent*, and in 1850 he was called to a chair of physics at Heidelberg, where, in company with Bunsen, he carried on those researches which at last resulted, in 1859, in the discovery which at once raised him to the first rank of natural philosophers, and opened a new era in the history of chemical analysis.

It was in 1814 that Fraunhofer studied and carefully mapped the dark lines in the solar spectrum, which have since been called by his name, and what Kirchhoff did was to show that these lines are a nature-given index—a tabulated and true statement of the constituent elements of the sun. Upon this discovery is founded that system of analysis which has led to the greatest strides in astronomical science since ancient times, and to the most searching analytical process available to the chemist. Before Kirchhoff's time, philosophers had observed that the light emitted by bodies in the incandescent state was capable of some useful application, and it had also been imagined that Fraunhofer's lines bore some relation to the composition of the sun; but the ideas were ill-defined.

It is well-known that sodium salts impart a yellow color to a Bunsen flame, and that potassium gives a violet. A mixture of these compounds gives a yellow color only, that color hiding the potassium flame; but under certain conditions of observation the violet color becomes prominent, and if a ray of light from such a flame be passed through a prism, the yellow and the violet, owing to their different degrees of refraction, are separated. This Kirchhoff observed, and more than this, for he showed that the yellow sodium ray always appeared in the spectrum at one particular spot as a bright yellow band, unalterable in position and intensity, no matter what the conditions of observation might be. So also with potassium and all other elements, each had its particular line or lines on certain parts of the spectrum. The apparatus which Kirchhoff employed in his investigation is called the spectroscope. It is simply an arrangement whereby a narrow ray of light is thrown on a prism, and the spectrum formed is viewed through a telescope. The best forms of the apparatus are provided with three telescopes, two for forming and conveying the narrow rays of light to the refracting medium, and the third for observing the spectra formed. One of the spectra is the spectrum of pure white light, necessary only for comparison with the spectrum of the substance under examination.

Kirchhoff had not proceeded far with his investigation before he observed that there was a distinct similarity between certain of the dark lines of the solar spectrum and the bright lines of some of the elements; for instance, Fraunhofer's dark line D occupied exactly the same position as the bright yellow line of the sodium spectrum. This led to the supposition that the dark line was in some way connected with sodium; and he found that when he passed a ray of white light through a sodium flame, the bright line of his sodium spectrum had vanished, and was replaced by a dark line exactly like Fraunhofer's line D. Here was an explanation of the dark lines. It was this—that the solar light, in its passage to the earth, traverses a belt of incandescent elements surrounding the sun. Fourteen of the known elements, all metals, were in this way found to be present in the sun's constitution. From these investigations of Kirchhoff's has sprung an entirely new system of observation of the heavenly bodies, which has enabled astronomers not only to prove the constitution of the planets and of stellar and nebulous bodies, but also their position in the cycle of creation and the surface changes which they are continually undergoing. To the chemist the discovery has been no less eventful. It places at his disposal an analytical method which, for delicacy and precision, cannot be surpassed.

The first fruits of spectrum analysis was the discovery of the metals rubidium and cæsium in 1860–61, by Bunsen and Kirchhoff. Crookes followed with the new metal thallium, and indium, with several other elements, have since been added to the number of the elementary constituents of the earth's crust, the latest being germanium, discovered by Dr. Carl Winkler within the past two years. All these we owe to the spectroscope. It is the final court of appeal to which the chemist resorts when there is any doubt about the identity of either a new or an old element. The precision and delicacy of the spectroscope may be judged by the fact that it is capable of detecting about a two hundred millionth part of a grain of a sodium salt. A six millionth part of a grain of a lithium salt may be detected by it, and it is only since Kirchhoff's discovery that it has become known that lithium is a very widely spread element, although existing in such minute quantities as to be unrecognizable by ordinary methods. The possibility of detecting minute quantities of elements in the course of qualitative analysis has had a wonderful influence in remoulding our ideas as to the localization of the elements. There were some which were said not to be found in the animal and vegetable worlds, but the spectroscope has dispelled the illusion.

Mr. John Williams recently remarked that the photographer detects impurities in chemicals long before the physician; but the camera is far behind the spectroscope in exactitude. The latter reveals too plainly that the adage "To the chemist all things are pure" is but a reversion of the true order of things, for it is difficult to get anything so pure that the spectroscope does not discover a foreign element in it. Mr. Crookes' discovery of thallium is not the only service which the spectroscope has enabled him to render to science, his papers on the "Genesis of the Elements," being perhaps the best tributes which the philosopher can offer to Kirchhoff's memory. Yttrium, the element which Mr. Crookes has so long worked upon, does not give a spectrum in the ordinary manner, but when its salts are subjected to the electric spark *in vacuo*, the resulting phosphorescence gives a spectrum which is quite characteristic. Moreover, a solution of an yttrium salt, if placed in the path of a ray of light falling on the spectroscope, creates an absorption or discontinuous spectrum of the element. That is to say, the solution stops all rays of light but those which are characteristic of the element, and these rays appear as bright bands of color against a dark ground. For a number of years Mr. Crookes has subjected yttrium to fractionations, which do not alter its chemical properties, as far as ordinary methods can detect; but in the course of time he has found that the fractionations have visibly altered the absorption spectrum of the element, and he even hopes to show that the half-dozen lines of the spectrum arise from yttrium molecules which differ in some respect from each other. Whether he will succeed in demonstrating this theory or not is hard to say, but undoubtedly his spectrum lines—or, as he calls them, "autograph inscriptions from the molecular world"—have a meaning as significant as the dark lines of Fraunhofer. But the spectroscope has had more humble applications in science.

Some years ago Professor Piazzi Smythe, the Astronomer Royal for Scotland, pointed out that on the approach of rain there appears a characteristic band in the solar spectrum, and this discovery is now utilized in meteorological observations. Even in such a herculean operation as steel making by the Bessemer process the spectroscope has been found to detect the change in the flame which marks the completion of the process. In pharmacy, also, it has its applications. The late Mr. William Southall was the first to notice (1869) that most of the Pharmacopœia preparations gave spectra containing lines peculiar and constant to each. Subsequently Mr. William Gilmour (Edinburgh) took up the subject, and showed that the spectroscope could tell with some degree of accuracy the purity and age of tinctures, as well as their strength in some cases, that other pharmacopœial preparations afforded characteristic and interesting absorption spectra, and that the spectroscope was an excellent means for the detection of admixture and adulteration of vegetable oils. We have by no means touched all the applications of Kirchhoff's discovery; but that a great man has passed away, and that the world is the better for his life, is admitted wherever science has found a footing.—*The Chemist and Druggist.*

The Crowning Achievement of Ophthalmic Surgery of the Present Century.

Under this title Dr. L. Webster Fox describes in the *Medical and Surgical Reporter* Professor Von Hippel's operation for the transplantation of the rabbit's cornea to that of man. By this operation Von Hippel has restored sight to an eye practically blind, and Dr. Fox predicts that it has a brilliant future in doing this kind of work. He saw the patient upon whom the first successful operation was performed, and learned its technique. We cannot do better than furnish to our readers Dr. Fox's very clear and complete description.

The patient operated upon was a young, healthy peasant girl, nineteen years of age, who suffered with a leucoma of the cornea of the right eye, obscuring vision to such an extent that qualitative perception of light only remained. The leucoma simplex obscured the central portion of the pupil, leaving, however, a circle of clear cornea at its outer margin, probably two mm. wide. The instrument devised by Prof. Von Hippel for performing this operation is most ingenious. The trephine is driven by a clockwork and the cylinder is graduated so as to regulate its cutting depth in the cornea. The leucomatous cornea opposite the pupil was removed by this instrument. The eyelids were separated by an ophthalmostat; then, under the influence of cocaine, the trephine was placed on the cornea perpendicular to its plane, the cylinder so graduated as to cut a certain depth, 0·7 to 0·9. This cylinder is then put in motion by a spring clock motion, much after the manner of a Dudgnon's sphygmograph. The hand simply steadies the instrument against the probe. After the circular incision is made comes the most important and delicate part of the operation, *i. e.*, the dissection of the leucomatous tissue from Descemet's membrane. This is done by grasping the inner lip of the incised tissue, and with the greatest care and precision this tissue is removed down to the basement membrane lying in juxtaposition to Descemet's membrane. If, after the removal of this circular piece of cornea, it is found that Descemet's membrane bulges forward through the circular opening, which in almost every case it does, a paracentesis of the anterior chamber is made at the corneo-scleral margin, relieving the intra-ocular pressure.

The rabbit selected from which to obtain the graft is a young, healthy doe. The eye, which is thoroughly cocainized, is drawn forward by an assistant who has inserted under the superior and inferior recti muscles two strabismus hooks. The eyelids are kept open with an ophthalmostat. The drawing forward of the globe enables the trephine to be inserted and watched more accurately in its incision. The cut is made through cornea and *Descemet's membrane.* This graft is then inserted in the incision made in the patient. A fine probe running through the cylinder of the trephine is pushed downward, forcing the graft into place. After the removal of the trephine the upper eyelid, which is drawn forward and downward, is pressed against the inlaid tissue, all being held firm by a pressure bandage, delicately adjusted, the patient, of course, lying on his back. After *three* days the bandage is removed, and the eye examined. If the graft is *in situ*, it will probably be somewhat hazy. If the edges have not turned upward, a successful result may be prognosticated.

Dr. Hippel recently showed a second patient and demonstrated his operation before the Ophthalmological Society of Heidelberg. The patient was found to have a visual acuity of $\frac{20}{200}$, and read Jaeger's No. 6, from which it would be inferred that the new cornea did not clear up completely.—*Med. Record.*

To Color Iron Blue.

One hundred and forty grammes of hyposulphite of soda are dissolved in a liter of water (4⅔ ounces to 1 quart); 35 grammes of acetate of lead are dissolved in another liter (one and one-sixth ounce to 1 quart); the two solutions are mixed, are made to boil, and the iron is immersed therein. The metal takes a blue color, such as is obtained by heating it.—*Revue Scientifique.*

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IMPROVED CONSTRUCTION OF GRAIN ELEVATORS.

A system of building and arranging the machinery for the work in grain elevators which is designed to reduce the cost of erecting and equipping such establishments, and whereby the work may be systematized and facilitated and the running expenses reduced, is illustrated herewith, and has been patented by Mr. John A. McLennan, No. 83 Metropolitan Block, Chicago, Ill. Fig. 1 is a transverse sectional elevation of

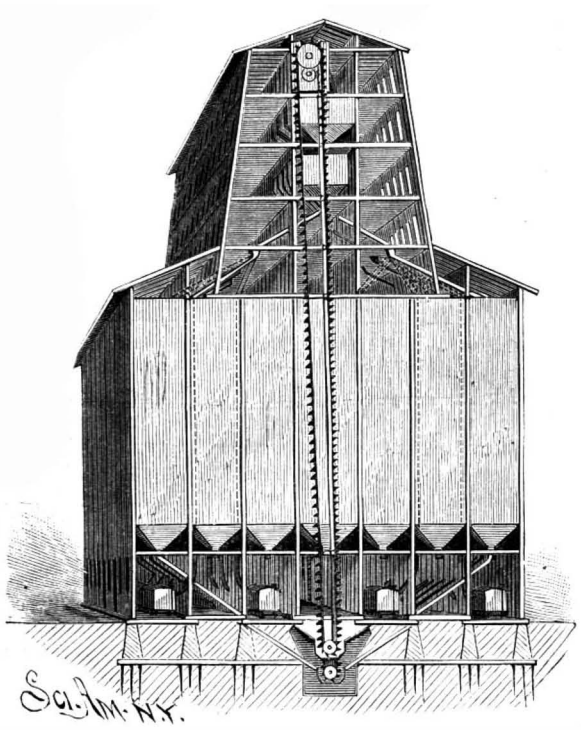


Fig. 1.—McLENNAN'S GRAIN ELEVATOR.

the elevator building, and Fig. 2 is a central longitudinal section above the bin floor. The cupola, running longitudinally with the body of the building, is divided into four floors, in the following order, from the top down—machinery floor, garner floor, scale floor, and spouting floor—the latter immediately above the bin floor in the body of the building. Near the longitudinal center of the structure, as shown in Fig. 1, are located a series of endless elevators, placed in pairs of one receiving and one shipping elevator, and extending below the basement floor, preferably through the same tanks, which are made of two depths, forming hoppers for the receiving and the shipping elevators and the boots thereof. The elevators extend to the machinery floor, and are all operated from the same shaft, a spout being attached to the head of each elevator to discharge the grain into either a receiving garner or its adjoining shipping garner, as shown in Fig. 2, these garners each occupying a separate bent in the building. Below these garners, and on the scale floor, are located, respectively, the receiving hopper and the shipping hopper scales, likewise arranged in pairs, and in the same relation with the bents of the building and with the receiving and shipping elevators, there being an arrangement of spouts for directing the grain from the scales to the bins, or to any of the pipes for loading the cars, as indicated in Fig. 1. The lower ends of the bins may also be connected with the transfer or shipping elevators by the spouts leading therefrom to the lower portions of the receiving hoppers.

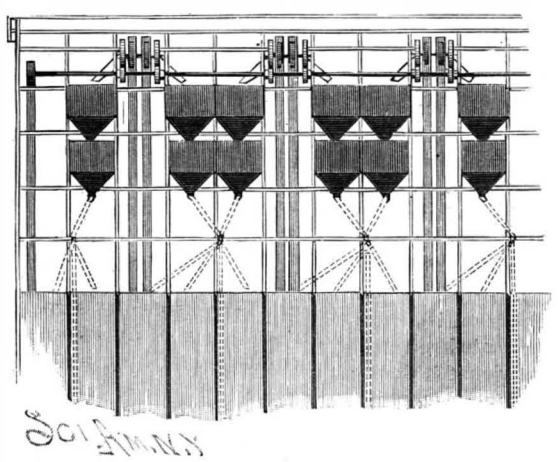


Fig. 2.—McLENNAN'S GRAIN ELEVATOR.

The distance between the pairs of elevators is governed by the length of the cars in use, as there must be the length of one car between each pair, in such manner that all the cars in a line may be unloaded simultaneously, the construction being such that both receiving and shipping may be conducted at the same time, with no loss of time or labor in shifting gangs of men, as is unavoidable under the old system, where the receiving elevators are placed in one line, leaving the distance between each elevator nearly the length of a car, and locating the shipping or transferring elevators in one or more lines parallel to the receiving elevators, but in different lines of bents. By this arrangement, also, both the receiving and shipping elevator boots may be put in the same tank, thus making a saving in the cost of construction, while (the transfer or shipping boot being on a lower level) the transfer spouts may be passed below the railway tracks and be stationary and yet out of the way, the loading of the two elevators together causing only one bent to be obstructed, and the work of both the weighers and the machinery men is greatly facilitated.

Improvements in Batteries.

In batteries employing two liquids, it is of much importance to keep them separate, and hitherto this has been only imperfectly done. Again, in a single fluid battery, where the depolarizer is a powder, it is very difficult to prevent the contact of this latter with the positive electrode.

MM. Dun, Montanus, and Hasslacher have nevertheless succeeded by solidifying or gelatinizing one of the liquids. This preparation is not a bad conductor, and above all is not liquid, which is important in batteries where the depolarizer is a soluble metallic compound, as, for example, where the electrodes are composed, one of zinc, the other of lead or copper, the depolarizer being sulphate of copper.

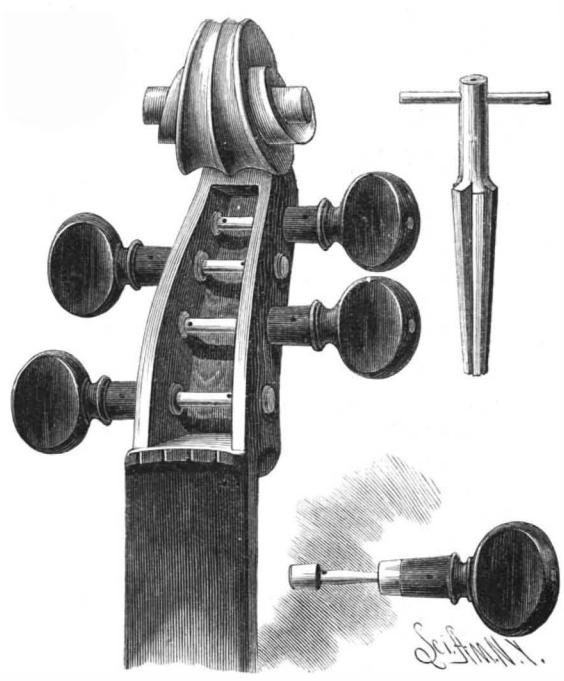
Such an element can be thus mounted: On the bottom of a glass vessel a plate of zinc rolled into a cylinder or spiral is placed, to which a conductor insulated with gutta percha is attached. By adding starch to caustic soda a gelatinous mass is obtained, which is first liquefied by heat, and then poured into the vessel until its level rises one centimeter above the zinc plate. After cooling, two pieces of wood are placed across the glass vessel to which the negative electrode is suspended, composed of a perforated plate of lead, bent into the shape of a basket, in which crystals of sulphate of copper are placed. When the second conductor is connected to this plate, water has only to be added for the battery to be in working order.—*Revue Scientifique.*

AN IMPROVED ORE JIGGER.

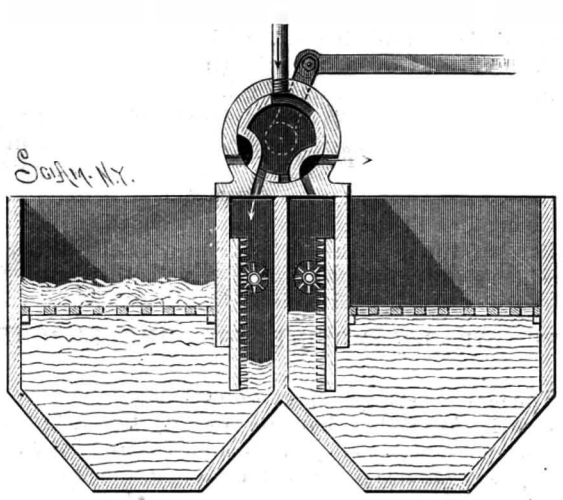
A simple and effective device for washing and separating ore is represented in the accompanying illustration, and has been patented by Messrs. David Hill and George W. Hall, of Georgetown, Col. The inclosing walls form large main compartments and small side compartments, the latter communicating with the large compartments below the partitions and vertically moving gates shown. The small compartments are closed at the top by a block, in a chamber of which is fitted a rotary valve, operated by a crank and connecting rod. A constant pressure of air, steam, or gas is supplied to the interior of the valve, and the reciprocation of the valve admits intermittent sudden blasts upon the surface of the water in the small compartments, suddenly forcing the water downward there and correspondingly elevating it in the large compartments, thus causing pulsations which wash and separate the ore upon the perforated tables just above. The course by which the compressed air, etc., is supplied to the valve, and thence admitted to the compartments, and of its escape through the exhaust, is indicated by the arrows. The intensity of the pulsations is regulated by raising and lowering the gates, which are provided with racks to engage with pinions upon shafts projecting from the side of the water tanks.

AN IMPROVED VIOLIN TUNING PEG.

A straining peg for violins, which is easy to turn and not liable to fly back, nor stick in damp weather, and with which the different strings are more readily tuned exactly as desired than is possible with the ordinary straining peg, is represented in the accompanying illustration, and has been patented by Mr. Samuel W. Wilcox, of Milford, Mass. (lock box No. 44). It is composed of a handle piece and a foot piece, connected by a junction piece of metal of much smaller diameter than the adjacent ends, the end of the string being held in this junction piece in a small hole made to receive it. The parts of the peg which have their hold in the violin head, on either side of the junction piece, are slightly cone-shaped, or tapered, in the same direction from the thumb piece to the farther side, whereby the peg can be easily inserted to give sufficient friction, and, from the smaller diameter of the central portion forming the junction piece, the string can be wound to better advantage, and with less liability of the peg slipping back. This is also of great advantage in tuning, the tuner not being so likely to get a tone or two out of the way by a slight turn of the thumb piece as with the ordinary peg. A special peg is also made for the E wire string and silk string, as shown in one of the small figures, by which such strings can be as easily managed as the gut strings. A reamer, tapered in the same direction as the pegs, is also shown, by means of which the holes may always be kept in perfect gauge for the accurate fitting of the pegs.



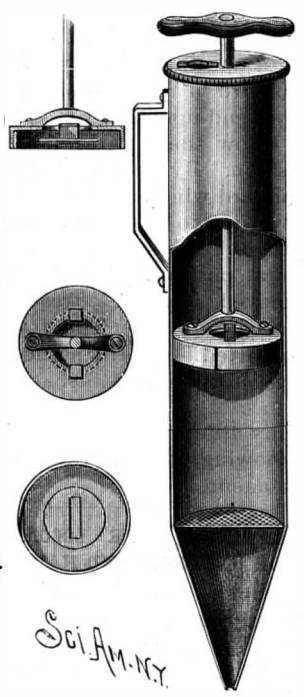
WILCOX'S TUNING PEG FOR VIOLINS.



HILL AND HALL'S ORE JIGGER.

AN IMPROVED VERMIN EXTERMINATOR.

A device to facilitate the ejecting of sulphurous or other acid or destructive fumes or smoke into the holes or places where vermin resort is represented in the accompanying illustration, and has been patented by Mr. Wm. A. Loughry, of Odessa, Buffalo Co., Neb. It consists of a metallic cylinder or tube with funnel-shaped nozzle, fitted at its rear end with a removable cap, a piston being fitted to work within the cylinder, and operated by a rod passing through a hole in the cap, such rod having either a metal or wooden handle. The small figures represent back, front, and sectional views of the piston, which is of an inverted cylindrical cup shape, with its side split so that the ends overlap one another, the rod being secured to the back of the piston by a cross arm or brace extending over a central aperture in the back of the piston, the aperture being closed by a self-supporting valve adapted to close in the forward stroke of the piston. The cap at the rear end of the cylinder is similarly fitted with a self-supporting valve, controlling an aperture on one side of its center. The valve construction is simple and effective, neither the valves nor piston requiring packing liable to be injured by jets of flame, smoke, or products of combustion, while the parts are not likely to bind from expansion. In operation, the cylinder is charged with the necessary combustible and medicated material, as with hay, straw, etc., sprinkled with sulphur or carbolic acid, and, the material having been fired, the piston is operated to force the fumes or smoke into the holes or places where the vermin may be concealed. The valve in the cap at the rear closes when the piston is being drawn backward, but opens when the piston is being forced forward. In the latter movement the valve in the piston closes, causing a continuous stream of smoke through the nozzle, while there is no back suction.



LOUGHRY'S FUMIGATOR.

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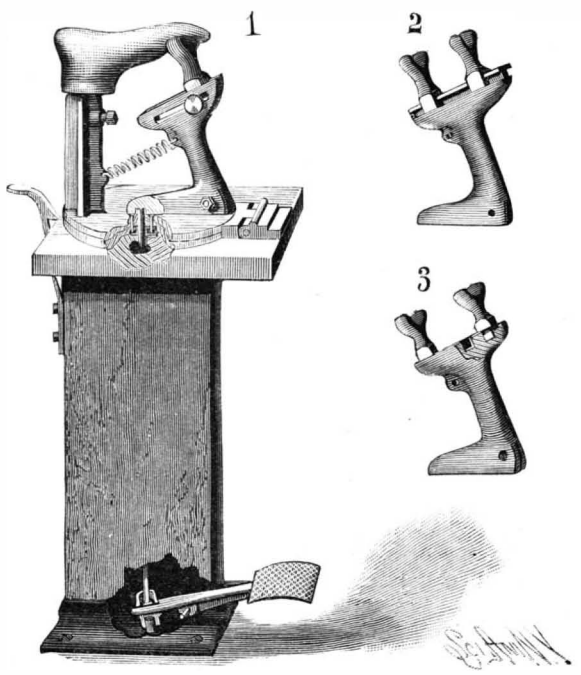
AN IMPROVED SHOEMAKER'S PEGGING JACK.

A jack by which the last may be securely supported, and held in an inclined, vertical, or horizontal position, or revolved in an inclined or horizontal position, to facilitate the pegging, heeling, and finishing of a boot or shoe, is illustrated herewith, and has been patented by Mr. George Dorwart, of No. 4628 Ridge Avenue, Roxborough, Philadelphia, Pa. Two circular plates are mounted upon a box stand, the upper plate adapted to revolve upon the lower one, and both plates being held in contact. The lower plate has a rear peripheral extension hinged to a block rigidly secured to the table, whereby both plates may be carried upward to a vertical position when desired. To retain the plates in their normal or horizontal position, there is a spring catch secured to the front side of the stand, and engaging with a lip integral with the lower plate. A post is cast integral with or attached to the outer face of the upper plate, a pin which holds the last being adjustably held in a longitudinal aperture of the post by a set screw. Opposite the post, upon the upper plate, and near its periphery, is cast a lug upon which is pivoted a standard adapted to carry the toe rest. This standard has at its base an inwardly projecting integral arm, resting upon the center of the upper plate, there being at the central point a recess in alignment with apertures in the two plates and in the bed of the stand. Through these apertures, and in contact with the arm of the standard, a rod is projected having a bearing at the lower end upon a treadle plate, the treadle, immediately below the lower end of the rod, having a rubber cushion. By pressing upon the treadle, the arm of the standard which carries the toe rest is raised to give an elevation to the last, which is returned to its normal or horizontal position, when the foot is removed from the treadle, by the coil spring. The toe rest supported upon the standard is capable of being detachably and adjustably secured thereto in many different ways, Figs. 2 and 3 showing other methods of attachment.



DORWART'S PEGGING JACK.

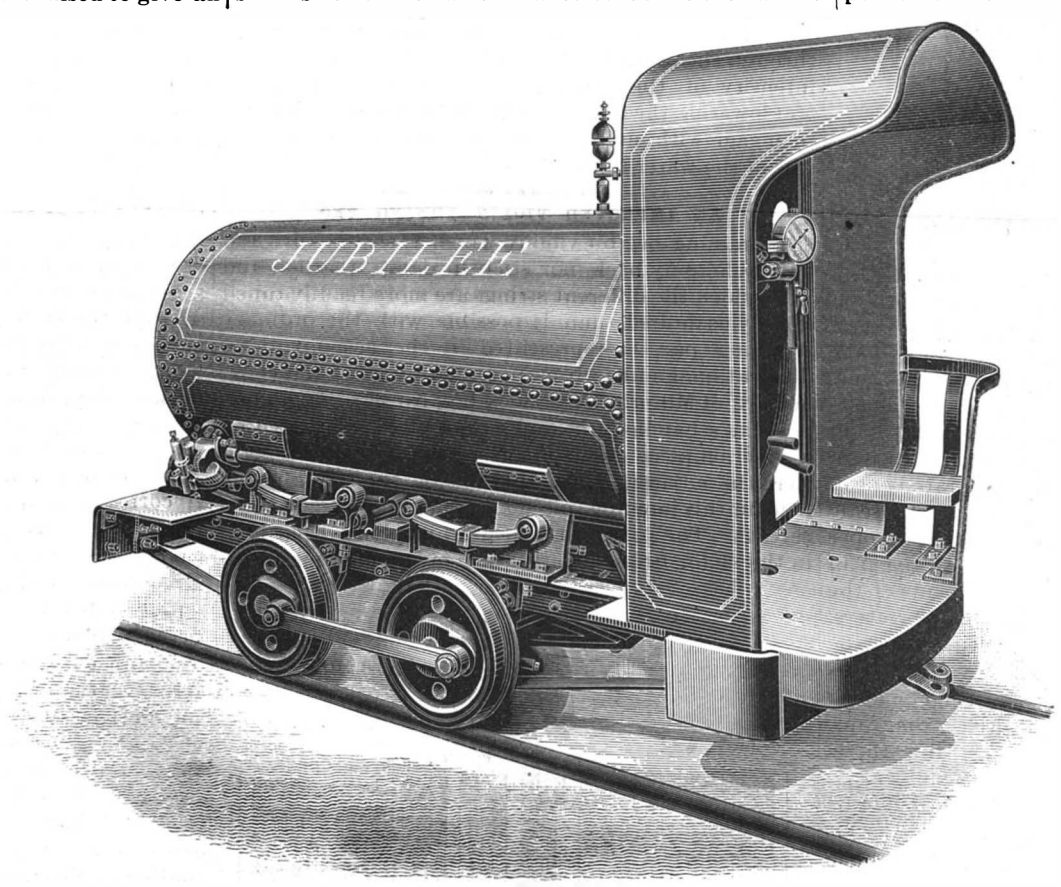
COMPRESSED AIR LOCOMOTIVE FOR UNDERGROUND HAULAGE.

Among the various systems of underground haulage shown at the Newcastle exhibition is one employing compressed air, and which deserves special mention. This system has been introduced by the Grange Iron Company, of Durham, and is in use in several pits in that district. We illustrate, in the annexed engraving, the locomotive exhibited at Newcastle. It is a four-wheeled engine, with inside cylinders, and the portion which in an ordinary steam locomotive would be the boiler is replaced by a cylindrical reservoir containing air under pressure. This locomotive has been shown in action since the opening of the exhibition, and drawing generally four tubs, but sometimes six, each weighing 25 cwt. The total weight of the engine is about 2 tons.

The cylinders are 4 in. diameter by 7 in. stroke, and the engine runs on a 33½ in. gauge. On a fairly good and level road it will exert a tractive force of 500 lb. on the drawbar, allowing a maximum load of 12 tons to be hauled. When drawing 5 tons on a fairly good road, the engine will run for about one mile before the air charge in the boiler becomes exhausted. The air compressor exhibited consists of a vertical engine with two steam cylinders each 12 in. diameter and two air cylinders each 8 in. diameter, the air being compressed in two stages to a final pressure of 400 lb. per square inch. The air is taken in at the top of the piston, and compressed through a water chamber into an annular space on the under side of the piston, whence it is delivered through a copper coil, immersed in water, to a receiver from which the locomotive obtains its supply of air, very much in the same way as an ordinary steam locomotive receives its supply of water through a hose.

The compressing machinery is usually placed on the surface, and the air under pressure is taken down the shaft and along the workings in wrought iron pipes, receivers being installed at suitable places throughout the mine. Each receiver has a cock and filling pipe with swivel joints attached, by means of which a locomotive coming up to the receiver can be supplied with a fresh charge. The whole operation of stopping, charging, and starting again is said to occupy scarcely a minute.

The engine is constructed for a working pressure of 75 lb., and the reducing valve, by which the air pressure in the reservoir is reduced to whatever may be required for the working of the line, is fitted to the reservoir shown in our illustration immediately behind the buffer plate. It might seem at first sight that the double conversion of energy entailed in this system would have the disadvantage of a low total efficiency, but as compared with rope traction this objection need not be considered. Mining engineers are accustomed to lose as much as 50 per cent, and in some cases 80 per cent of the total power available on the rope alone, and in coal mines, where fuel is cheap, the question of efficiency is not of great importance. On the other hand, a small locomotive, the speed of which is at all times under perfect control, has great practical advantages over the cumbersome method of rope traction, and it is no doubt due to this quality that these little mining locomotives are beginning to find an extended use.—*Industries.*



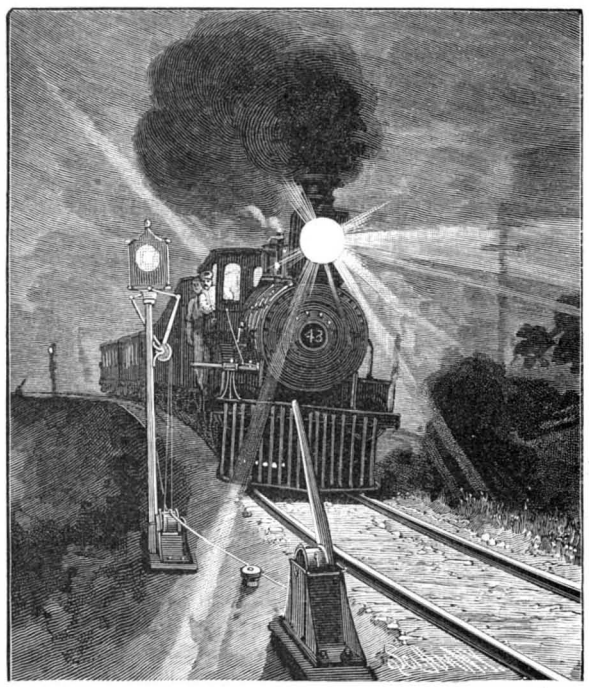
COMPRESSED AIR LOCOMOTIVE FOR UNDERGROUND HAULAGE.

A Large Shell for the Dynamite Gun.

Brown & Bros., of Waterbury, have completed the shell for a projectile of enormous size, for the dynamite gun to be used on the new cruiser now being built for the government. It is a seamless drawn brass shell, 6 feet 8 inches long, 14 inches inside diameter, three-sixteenths inch thick, and weighs 200 pounds. The shell with its conical head is all in one piece, being forced into shape by a heavy hydraulic ram. The drawing of the shell was witnessed by Lieut. Zalinski and G. H. Reynolds, consulting engineer of the Pneumatic Dynamite Gun Company. The shell is intended to carry 600 pounds of explosive gelatine, shells carrying 55 pounds only having been used in the recent experimental trial in New York harbor, when a small vessel was demolished at a distance of a little over a mile. The new 150 ton Krupp gun now being built will carry a shell 15½ inches diameter and 5½ feet long. This shell will weigh 2,310 pounds and require 1,067 pounds of powder to fire it. The difference in the cost of making and employing these two varieties of guns, carrying shells of about the same size, is something enormous.

AN IMPROVED RAILROAD SIGNAL.

A signal especially adapted for use at curves in railroad tracks, as a warning to engineers and trainmen that a train is on the curve close in front of them, or as notice that the track is clear at the curve, and likewise adapted for use at crossings, to signal the approach of a train, is shown herewith, and has been patented by Messrs. David Vinton, Jr., and F. H. Vinton, of Williamsburg, Mich. The signal is supported by a post at one side of the track, and consists of a box glazed at opposite sides with red and green glass, adapted to hold a lamp or lantern, and fitted to revolve on top of the post. A shaft is held in lugs fixed to the post, two rollers being journaled on the shaft, the rollers carrying rigid arms which stand at right angles to each other, and are connected at their outer ends by rods with diagonally opposite corners of the revoluble signal. In a box at the base of the post is journaled a drum, connected by cords with the peripheries of the rollers, so that the turning of the drum in one direction will pull the signal one quarter around, to display a different colored glass, and turning the drum back again will return the original signal to place, the red and green glasses with the lamp adapting the signal for day and night use. A rope or chain attached to the drum extends a distance along the track, being connected at its farther end with a roller journaled in a box carrying an arm adapted to be struck by a trip bar on the locomotive. A rope or chain extends, in a similar manner, from the signal post to a trip arm in the opposite direction. With this arrangement, when that portion of the track between the trip arms is clear of trains, the trip arms will both lean away from the signal, but the trip bar of an approaching locomotive, striking and throwing over the first trip arm, draws on the rope to turn the signal, thus indicating that a train is on this section, and at the same time swings over the farther signal, which is also struck by the trip bar of the locomotive in passing to turn the signal back again to safety. The trip arms or levers are to be set at a sufficient distance apart, and away from the signals, to give ample time for a train to pass safely from or clear of a curve in the track where the signal may be placed.



VINTONS' RAILROAD SIGNAL.

Trees and Soils.

Many have observed that in some localities trees of a special variety abound, while in the same vicinity other kinds flourish, and yet none of the kind found in another part of the same town. Some one has discovered that pines and their companions, the birches, indicate a dry, rocky, sandy, or gravel soil; beeches a dryish, chalky, or gravel soil; elms and limes a rich and somewhat damp soil; oaks and ashes a heavy clay soil; and poplars and willow a low, damp, and marshy soil. Many of these trees are found growing together, and it is only when one species predominates in number and vigor that it is truly characteristic of the soil and that portion of the atmosphere in connection with it.

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OUR NEW NAVY.

When a maritime nation, once known for its prowess on the high seas, suffers its fleet to fall into a decline, refusing either to re-enforce or improve it for nearly a quarter of a century, the result of its first efforts to build and equip a fleet after new and improved designs may not improperly be called a new navy. It is this nucleus of a new navy, this first endeavor to construct ships worthy to bear aloft our glorious ensign, that we illustrate in this number.

In the old-time war fleet the ability to fight its way up to close quarters with the enemy, and even to haul up alongside and lay him aboard, was a necessary attribute. Recent improvements in heavy rifled ordnance has changed this; the art of attack has advanced beyond that of defense, and the big rifle being able to pierce the heaviest armor that can be floated, modern naval warfare has been reduced to a pounding match at long range, in which the result depends on the relative skill of the competing gunners, or to the destructive powers of other implements and engines of war, according to the conditions under which the combat is waged. Thus the fleet of to-day consists of the heavily-armored war ship, which may also be a ram, that is to say, fitted with a steel spur projecting under the water in front of her forefoot; the commerce destroyer, a swift, light-armored vessel; the floating battery, intended for harbor defense; the torpedo boat, and the torpedo catcher, intended to beat off the torpedo boat, or frustrate its attempts to come up and discharge projectiles. In our illustration we show the four new steel cruisers, Chicago, Atlanta, Charleston, and Baltimore; the dispatch boat Dolphin; a torpedo boat; and last, but by no means least, the dynamite cruiser.

It is not our purpose to enter here into a discussion of the merits and defects of these vessels, or to compare their powers with those of the European fleets, confining ourselves as closely as possible to a mechanical description of them as they are. All were built from designs furnished by a board of naval experts, be it said containing some of the best talent in a navy by no means deficient in that respect. These four vessels are constructed of steel, made in this country, having a tensile strength of about 60,000 pounds to the square inch, and a ductility in eight inches of quite 25 per cent. Here are the dimensions of the Atlanta:

Length between perpendiculars	270 feet.
Length on water line	276 "
Length over all	283 "
Depth from garboard strake to underside of superstructure deck	34 "
Height of main deck port sill from load water line	11 "
Freeboard at extremities of superstructure	9 "
Breadth, extreme	42 "
Draught at load water line, mean	16 " 10 in.
Displacement at water line	3,000 tons.
Area of plain sail	10,400 sq. feet.
Complement of men	230
Battery—four 8 inch and six 6 inch B. L. R.	
Indicated horse power	3,500
Sea speed	13 knots.
Capacity of coal bunkers	580 tons.

Eight transverse bulkheads extend up to the main deck, there being thus nine main compartments, the engines taking up one. Throughout the space occupied by the machinery there are longitudinal bulkheads on each side, which are filled with coal lying eight feet thick as side protection to the engines above the water line, and five feet thick below the water line. These coal bunkers have a possible capacity of nearly 800 tons; the ship having the power to steam 2,500 miles under full head and about 5,300 slowed down. In all, the Atlanta has seventy-three water-tight compartments. The pumping power of the pumps, steam and circular, is together 2,500 tons per hour; and should any compartment be shot through, the whole of this great suction power could be concentrated to keep it free of water. Then there are hand pumps that can be connected with any one of the seventy-three water-tight compartments. Over the machinery there is a steel deck 1½ inches thick. The ship has a double bottom and a bilge keel. Her outside plating is 23 pounds to the square foot. The engine is of the three cylinder compound horizontal order, of 3,500 H. P. indicated, having one 54 inch high pressure cylinder and two low pressure cylinders, 74 inches in diameter. The shaft is 16 inches at the main journals, and of steel; the screw 17 feet in diameter, with a mean pitch of 20 feet. There are eight horizontal return tubular steel boilers apportioned into two sets by a water-tight bulkhead. Naval Constructor Bowles thus describes the battery of the Atlanta:

"Outside the forward port angle and the after starboard angle of the superstructure, an 8 inch long rifled gun will be mounted in a barbette about 3 feet high, built of 2 inch steel plates. The forward gun has a train from 40° abaft the beam on the port side, sweeping the whole deck forward to 30° abaft the beam on the starboard side. Similarly for the after gun. Within the superstructure six 6 inch B. L. R. will be mounted, two on each broadside, with a train of 60° before and abaft the beam; one, forward in the starboard angle of the superstructure, may fight either through a forward or a broadside port, giving a total train of from 20° across the bow to 60° abaft the beam. The remaining gun is similarly mounted on the port side aft."

The Atlanta has made a trifle over 16 knots under favoring conditions.

The twin screw steamer Chicago, like the Atlanta, is an unarmored coal-protected steel cruiser. Here are her dimensions:

Length between perpendiculars	315 ft.
Length on water line	325 ft.
Length over all	334 ft. 4 in.
Depth, garboard strake to underside of spar deck	34 ft. 9 in.
Height of gun deck port sill from load water line	10 ft.
Height of spar deck port sill from load water line	18 ft. 6 in.
Breadth, extreme	48 ft. 2⅛ in.
Draught of water at load line, mean	19 ft.
Displacement	4,500 tons.
Area of plain sail	14,880 sq. ft.
Complement of men	300
Battery—four 8 inch long breech loaders in half turrets, eight 6 inch and two 5 inch on gun deck.	
Indicated horse power	5,000
Sea speed	14 knots.
Capacity of coal bunkers	940 tons.

The outside plating is $\frac{9}{16}$ of an inch in thickness, weighing 23 pounds to the square foot, having a double plate at the water line reaching to within 70 feet of the stern, and a great steel spur forward for ramming. She can go 3,000 miles at a speed of 15 knots, and twice that at reduced speed.

In her battery there are four 8 inch rifles, each of 12 tons, the same being mounted on the spar deck in projecting half turrets, the trunnions being about 20 feet above the water line. Added to this there are six 6 inch breech loading rifles, each of four tons, mounted on the gun deck in broadside. In recessed ports aft are two 5 inch guns. A secondary battery of rapid-firing six pounders completes her armament.

The principal features of the dispatch boat Dolphin are:

Length between perpendiculars	240 feet.
Length, extreme	256·5 "
Breadth, moulded	31·85 "
Breadth, extreme	32 "
Depth from top of floors to top of main deck beams	18·25 "
Depth from base line to top of main deck beams	20·07 "
Top of main deck at side above load water line	6·28 "
Mean draught	14·25 "
Displacement at mean draught	1,485 tons.
Complement of men	80
Battery—one 6 inch pivot, four revolving cannon.	
Indicated horse power	2,300
Speed	15 knots.
Capacity of coal bunkers	310 tons.

Her armament consists of one 6 inch breech loading rifle set on a shifting pivot and four 47 mm. revolving guns. The Boston is a sister ship of the Atlanta, and similar to her in dimensions and armament. The torpedo boat shown in the illustration is said to have made 19 knots along the measured mile. She is intended to run upon the enemy at nightfall, in thick weather, or when the smoke of battle conceals her movements, either strike him with a spar torpedo, or direct upon him torpedoes of the Whitehead type when close aboard.

The most interesting of all, because of its novelty and the terrible weapon it wields, is the dynamite cruiser. She is fitted with a gun sixty feet long, in reality a brass tube from which is impelled by means of compressed air charges of explosive gelatine. This is an American invention, and of its utility an authority says:

"The torpedo shells projected by the pneumatic torpedo gun can attain the range of two miles in about twenty-two seconds, and they can be directed at the enemy much more accurately than appears possible with the others. If missing the target, the only expenditure is the shell and its charge, and a large number can be showered upon the enemy in a short period of time. A much larger number can be stored and carried than of other torpedoes. As an auxiliary arm, placed for defense of harbors and fortifications, they can be brought into use at the time when the enemy's fleet come to closer quarters, that is, within its effective range of, at present, two miles. It is hardly questioned that the course of an action may bring the combatants to such close quarters. In addition to this, these torpedo shell-projecting machines may be placed on board of swift-moving boats, which could approach a beleaguering fleet within a mile and deliver a most damaging fire. Where the enemy has succeeded in removing existing torpedo obstructions, these machines can shower its pathway with torpedoes which, when the depth is suitable—say 50 or 60 feet, or less—can be arranged to explode either directly upon reaching the bottom, or at any desired interval.

Fire and Water Proof Paper.

A paper that resists the action of both fire and water has, it is said, been recently invented in Germany by a Herr Ladewigg. The manufacture is accomplished by mixing 25 parts of asbestos fiber with from 25 to 30 parts of aluminum sulphate, and the mixture is moistened with chloride of zinc and thoroughly washed in water. It is then treated with a solution of 1 part of resin soap in 8 to 10 parts of a solution of pure aluminum sulphate, after which it is manufactured into paper like ordinary pulp.

A Remarkable Petroleum Well.

The Russian paper *Caspian* gives the following interesting details of one of the largest naphtha fountains yet known, which has lately broken out near Baku, and which threatens to inundate all Balakhani. The naphtha, owing to the pressure of the gases which accompany it, rises to a height of 280 feet to 420 feet, and is carried away by the wind to a great distance, falling like fine rain at the more distant parts of the district, but near the fountain coming down in torrents that form rivers and streamlets. Further on it falls like sleet, and settles in a layer on all the buildings in the neighborhood. These naphtha rivers flow for a distance of more than half a mile, and pass through wells, works, reservoirs, and inhabited houses, etc. Unfortunately, all the reservoirs in the neighborhood were full when the fountain broke out, and the oil was thus wasted. Owing to the stillness of the atmosphere, at one time the gases which accompany the naphtha spread in a heavy layer for more than 280 yards, filling the houses and placing their inhabitants in a most dangerous position, especially at night, when fires were lit. The sand and dust thrown up by the fountain form a hill of considerable size, and have buried the boiler house of the mining company's works, and all buildings in close proximity to the fountain. There is no doubt that any exposed flame would set the whole district, from the mining company's works to the Sabounchi railway station, in one blaze. Many efforts have been made to stop the fountain, but all proved unavailing, for after five or six hours the fountain would again burst forth with all its former vigor. For some days the fountain has been left to play without hinderance, and has increased in power. Thanks also to a strong and changing wind, the naphtha has been scattered in every direction, turning the whole district into a petroleum swamp. The naphtha pours from the roofs of the houses, on to which also fall the earth and stones carried up by the oil.

Chicago to Have a Garbage Crematory.

The City Health Department of Chicago is directing considerable attention to the question of getting rid of the city garbage. Health Officer Thompson has, according to the *Industrial World*, been to Des Moines, Iowa, and witnessed the workings of the garbage crematory in that city, of which he says: "The furnace is 18 feet long by 4 feet 6 inches wide, has a capacity of 50 yards of garbage daily, and cost, with the building, about $1,700. About two feet from the bottom of the furnace is a solid iron plate, and above that, and upon which falls the substance to be burned, is a heavy iron grating. In the center of the furnace is a circular hole, closed by a trap, into which was thrown, while I watched it, two dead horses, seven dogs, eighteen barrels of garbage, three hods of manure, fifteen bushels of rotten eggs, and three barrels of rotten fish. This was all consumed in one hour, with no offensive smell from the combustion and no smoke. The furnace was cold when started.

"There are two fires, one in front and another in the rear. The rear fire was started first. The refuse is dumped upon the grating through the manhole, thus being kept away from the fire, so as not to extinguish it. The heat from the flames in the front and rear rapidly dries the matter, and soon all is burning. The theory of the inventor is that if there were only one fire, the combustion would be offensive. The draught carries the smoke to the rear fire, which consumes the noxious gases and destroys all germs."

The Des Moines crematory is simple, and considered by Mr. Thompson as effective as any that he has examined, and it does not require much labor to attend it or consume much coal to operate it. The authorities of Chicago are bound to erect a garbage-consuming furnace of some kind, and according to Health Officer Thompson's report, the one above described is the one most likely to be tried.

New Invention in Calico Printing.

A correspondent writes to the British *Mercantile Gazette:* "The 'simultaneous' process of color printing promises to entirely revolutionize some classes of calico, velvet, and velveteen printing, and also the printing of advertisements in colors. The novel character of the 'simultaneous' process will be at once understood when I mention that by it, if required, 1,000 shades could be printed off at one impression. Instead of using engraved rollers as in ordinary calico printing, or stones as in the case of colored advertisements, the designs of pictures are 'built up' in a case of solid colors specially prepared, somewhat after the style of mosaic work. A portion is then cut or sliced off about an inch in thickness, and this wrapped round a cylinder, and the composition has only to be kept moist and any number of impressions can be printed off on calico, velvet, or velveteen, the colors being thoroughly 'fast.'"

THE fast locomotives used on the "two hour" trains of the Pennsylvania Railroad Company, between New York and Philadelphia, have 6 ft. 8 in. wheels, 18 in. cylinders, and 24 in. stroke. The engines do a mile in 50 seconds.

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Correspondence.

Notes on Bird Life in Texas.

To the Editor of the Scientific American:

In connection with the interesting article of Mr. E. M. Hasbrouck, on "Forms of Bird Life in Central Texas," in the SCIENTIFIC AMERICAN of October 22, I find the following memoranda in my note book, upon the subject of nidification: "Victoria County, Texas, September 26, 1887.—While hunting prairie chickens, on open prairie, my dog put up a dove (*Z. Caralinensis*). The bird went off with the peculiar fluttering, crippled movement that indicates the proximity of nest or young. On examining the locality, found nest on the ground, with two eggs. Incubation apparently just begun. As I had no means of carrying them, I did not take eggs."

"Victoria, Texas, October 19, 1887.—While quail hunting two miles west of this city, my dog nosed out of a bunch of high weeds a young mocking bird (*M. polyglottus*), which, from appearance of plumage and flight, was evidently not more than two or three days out of nest."

In regard to the great speed attributed to the chaparral cock or paisano, am afraid Mr. Hasbrouck derives his information on this point from the romances of some native Texan, rather than from personal observation.

So far as my experience with the bird goes, although they are certainly very swift of foot, they are by no means capable of attaining the exceeding high rate of speed with which they have commonly been credited.

I once undertook to run one down afoot, and would certainly have done so, if it had stuck to the road, as I was rapidly gaining on the bird, when it took to the chaparral. Have frequently raced them on horseback, and never failed to outrun and drive them into the brush, although I never succeeded in putting one to flight by chasing it. C. S. WELLS.

Victoria, Texas.

Drawings for Process Work.

To the Editor of the Scientific American:

Drawings for process work are made on all kinds of Bristol board, ledger paper, Whatman's drawing paper, grained drawing papers, such as Steinbach, Day's grained, enameled, printed and embossed cards, photographic paper, plain Saxe or Clemens leatherized, and heavy coated enamel papers, such as Day's scratch board.

The implements used for coarse work are ordinary writing pens and for finer work, Gillot's map pens, Crowquills, No. 290 Somerville lithographic pens, and Keuffel & Esser's lithographic pens. Some of the most beautiful line work can be drawn with a brush such as is used by miniature painters, viz., red sable No. 0 or No. 1, if it is trimmed down until but eight or ten hairs are left to form a point.

There are all kinds of ready ground drawing inks in the market, but none so good as freshly ground India ink, which can be ground readily, perfectly and absolutely black, in an ordinary saucer, and is the very best working medium that can be used for pen or brush work. Any ordinary saucer will do, and for an inkstand buy a common brass thimble, to which fit a cork. Fill the thimble with water as a measure of the quantity of ink required. Pour this into your saucer and rub up your India ink until you think it sufficiently black. Then keep up the rubbing five or ten minutes longer. Now add one drop only of glycerine, and rub a little more, and the ink is made. To mount the inkstand, cut a potato or turnip in half, scoop out a hollow for the thimble, using the flat cut surface as a base for the inkstand, and when the pen fouls, jab it into the vegetable, which will clean it. To pour the ink from the saucer to the inkstand, make a long gutter of writing paper, by which it can be poured in without spilling a drop.

Lithographic crayons, No. 1 Lemercier's or Currier's, are used for drawing on the grained papers, and can be mixed with pen work thereon. By warming the back of a drawing made with lithographic crayons, they are fixed more firmly to the paper and made blacker. Drawings on enameled board are made more readily with a brush than a pen. Solid blacks can be painted in sparingly with a camel's hair brush. Pen lines run into these solids, impinging on the blacks, can be picked up with the point of a sharp scraper and carried into the solids, giving the effect of a wood engraving. This work can be cross-lined with a brush, giving the effect of white stippling. All drawings for process work should be pure black and white, even the finest lines. Their color is best ascertained by using a magnifying glass.

BENJAMIN DAY.

48 Beekman Street, New York.

Mosquito Bites.

According to Dr. Gerard (*Archives*), the inconveniences resulting from bites by mosquitoes and gnats, especially when recent, may be relieved by rubbing the bitten spot with chloroform. The swelling quickly decreases, and the pain and itching disappear.

The Zalinski Dynamite Gun.

The illustrations of the recent trials of the Zalinski dynamite air gun, published in the SCIENTIFIC AMERICAN, were reproduced in *Engineering*, but its correspondent, in describing the experiment, could not refrain from sundry sneering observations. To do otherwise would not be English, you know. His remarks have called forth the following sensible comments from a correspondent of the latter paper:

"If your published account of the experiments with the American dynamite gun be a faithful record of actual occurrences, the invention promises to mark a new era in naval gunnery and warfare.

"It seems a pity that your New York correspondent should think fit to sneer at the views of theorists rather than to state their theories and show how they are erroneous. Theory is never contradictory to practice if all the circumstances surrounding each case are properly weighed and examined. Lieutenant Zalinski's success is probably due to his theories being nearer to the truth than the theories of those who disagreed with him. The Mark Twain style of your correspondent increases the difficulty of a reader who wishes to arrive at the real value of the invention; but as I understand that the small sketches on page 427 of *Engineering* are prepared from instantaneous photographs, I will with your permission examine them rather than the flippant remarks by which they are accompanied.

"Each sketch [see SCIENTIFIC AMERICAN of October 1, 1887] is practically scaled, because the length of the vessel, shown on Fig. 1, as she floated prior to her destruction, is 80 feet. It will be seen that her length of mast is about the same.

"The first important fact revealed by Figs. 4, 5, 6 is that the vessel was moored in water so shallow that it only covered her deck by about half a fathom after she sunk in say a depth of 2½ fathoms. Consequently, when the vessel was floating, she had a convenient shell arrester placed under her bottom at the best distance to insure a successful explosion in the event of the fuse being unduly retarded. The shells were fired at a high elevation, 15 degrees, and fell at a much larger angle. If the fuses of the second and third loaded shots were purposely arranged with an excessive retardation, the shells would be lying on the bottom when they exploded, and the great difficulties engendered by time fuses would thus be avoided. Whether this was done or not, the experiments would have been much more satisfactory and convincing had the vessel been moored in deep water.

"Figs. 2 and 3 show that the charges (of 55 pounds of high explosive) were at a very good submersion to obtain maximum effect when they exploded. Fig. 4 shows a shot in which the fuse was evidently arranged to explode the shell on graze. Fig. 6 shows that the shot there depicted was fired when the shell was only submerged 3 feet or 4 feet.

"The results which you have been enabled to publish are of the greatest interest, and it is to be hoped that our government will take the matter up without loss of time. The possibility of projecting large charges of high explosive to a considerable range is established. The accuracy of gigantic air guns, and the facility with which range can be altered by the air pressure, as well as the quick training of the guns, are also apparently indisputable. But the success of the system centers on the efficiency of the fuse, so that the charge shall explode when properly placed, both horizontally, as regards the position of the ship, and vertically, with reference to the water surface. To do this successfully in deep water must be very difficult. If it can be done, both the inventor and the United States authorities who have so energetically enabled him to develop this new engine of war must be congratulated on their success.

"If the invention be as good as it now seems to be, it will be sheer waste of public money to spend large sums on any form of controlled locomotive torpedoes, however perfect they may be; for it is evident that no system of the kind can compete with one that hurls large torpedoes through the air to their destination at the rate of one per minute per gun. J. T. BUCKNILL."

Ants and their Ways.

Much has been written about the industry and sagacity of the ant. Dr. Bonavia, in a recent number of the *Gardeners' Chronicle*, relates his observations on the habits of ants in India, in which he says:

"On one occasion I killed a wasp—the small yellow wasp that is so common in India. Soon after, I observed an ant moving about on the sill of a window. It struck me as a good opportunity to observe what steps this ant would take if brought in contact with the dead wasp. I placed the wasp in the path of the ant and watched the result. The ant, on finding the wasp, climbed over it and explored it thoroughly in all directions. Having satisfied itself that this was a good find, it descended, and ran down the wall of the window and across a very rough grass mat made of the Saccharum moonja (the moonj or surput matting of India). It galloped across the room over this rough surface as hard as it could go in a particular direction, and disappeared under the wooden sill of a door. I still watched to see what would happen. Presently a long string of ants in single file came out and followed the exact course that the foraging ant had taken. They crossed the mat in the same course, and went up the wall straight to the wasp. I left them in peace, and some time after I found only the shell of the wasp. They had eaten up all its interior, and returned home. It is evident that single ants leave the nest, as scouts or explorers, on foraging expeditions, and go to long distances. By some scent left on their course, they are able to retrace their steps to their nest. The ants in the nest, probably by some scent of the body found which the exploring ant brings with it, are made to understand that something good to eat has been found. Guided by the exploring ant, or by the scent it may have left in its track, the whole nest or a portion of it sallies out, and goes straight to the find. If the body found is easily dragged home, the column does so, in procession, some preceding, some dragging, and some following the treasure. Otherwise they set to and eat up what portions they can of the thing found. This trait in ants is most interesting. Solitary ants are seen in all directions exploring and careering up and down the stems and leaves of plants. If they come across a flower with its nectar approachable, that flower quickly becomes crowded with other ants. Their feeling organs appear to be their antennæ. As they move about and explore, their antennæ are always very active, and projected before them. They stop here and stop there, and move these sensitive organs as if their whole attention were directed to the impressions received by them, and it appears they decide what course to take according to the impressions conducted by their antennæ. When two ants of the same kind going in opposite directions meet they never "cut" each other and pass on, but invariably stop and have a chat, so to speak, and communicate to each other the news. How they do this I cannot tell, nor can I tell exactly how light communicates to our own brain the presence of objects outside of us and at a distance from us.

The Water Jet.

One of the questions submitted to railroad companies by the International Commission of the Congress of Railroads was as to the question of the use of a jet of water or steam to increase the adhesion of locomotive wheels. The companies have submitted answers to this question, which are published in the *Bulletin* of the Commission. The Mediterranean Railroad, of Italy, submitted an elaborate report by Chevalier J. Silvola, stating that experiments were begun in 1879 on the Pontedecimo-Busalla line, which were so successful that the water jet was applied to 35 eight-coupled locomotives used on the heavy grades of that line. This resulted in a considerable saving, the expenditure for sand having been $4,000 a year, while the cost of the steam or water jet was only about $500. An incidental advantage was the absence of the sand, which at one time proved a serious obstacle in the way of maintaining good drainage in the Giovi Tunnel.

The further opinion is advanced that, while the adhesion is not increased quite so much by the use of water as of sand, the water jet system has the advantage in that it does not interpose any resistance to the movement of the train, as does the sand, more or less of which remains on the rails. The engine drivers much prefer the water jet system, as they say it makes the train lighter—that is, it draws more easily. It is stated also that the abandonment of the use of sand is accompanied by a lessening of the wear of rails. This result is supported by numerous observations, and is further corroborated by the observations of M. Couard on the Sorderettes Tunnel of the Paris, Lyons & Mediterranean Railroad and those of M. Egger on the Swiss Central Railroad. The water jet system, it has been said, will not answer in cold climates, but it has been very successful on the Swiss Central and Gothard lines, both of which are subject to very low temperatures. The Gothard railroad has 55 locomotives fitted with the water jet, and thoroughly approves the system. On this road, although there are long tunnels and steep grades, making the use of heavy locomotives necessary, the wear of the rails has been much lighter than was expected. The results so far obtained justify the making of extended experiments with the water jet system, in the opinion of the commission.

The British Army Rifle.

According to Sir Henry Halford, the new army rifle is to have a very small bore, about 0·3 inch, and will be a repeating rifle, with a magazine holding 10 shots. Owing to the reduction of bore, each soldier will be able to carry 166 rounds into action as easily as 100 rounds of the present ammunition. The trajectory of the arm will be very flat, so that, it is expected, as good shooting will be made at 1,000 yards with the new rifle as was made at 600 yards with the Martini-Henry, and at the same the recoil will be reduced to one-third that of the present arm.

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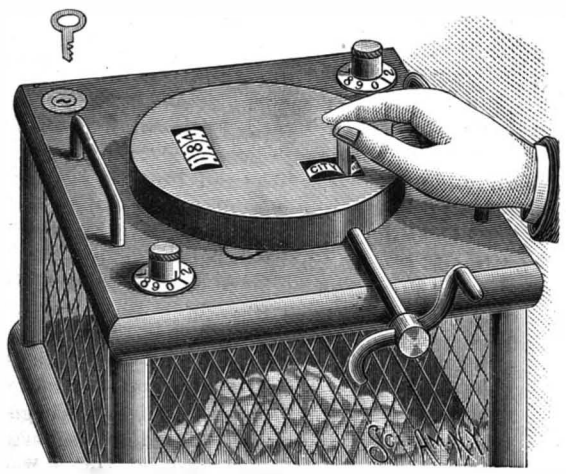
THE NEW JERSEY BALLOT BOX.

We illustrate the new style of ballot box used in the late election in the State of New Jersey. It was ordered to be used by State enactment. The bill which bore the serial number 317 was introduced into the lower house on March 17 of the present year. It passed the house March 29, and on April 6 passed the senate. So far nearly $20,000 have been expended by the State upon the boxes. From all accounts their use does not seem to have been an unmixed blessing.

The box is of general cubical shape, with glass sides,



THE NEW JERSEY BALLOT BOX.

protected by wire netting. Its top is secured in place by three locks. One of these opens with a key which is held by one of the inspectors. The other two locks are keyless combination locks. Each of the other inspectors locks one of these, using a private combination known only to himself. Thus the box cannot be opened except by concurrent action of all three.

About the center of the cover is the aperture for introduction of the ballot. This is a small opening filled up by portions of two tangential rollers or wheels. To introduce a ballot it has to be thrust endways between the two rollers. Then on turning a handle it is drawn down, and the voter can see it fall into the box beneath. In effecting this rotation, an inscription is printed upon the ballot. The desired word, the name of the county, for instance, is carried in raised characters by one of the wheels that draw the ballots down. As the wheel rotates and feeds the ballot into the box, it also impresses upon it the inscription.

By this rotation, registering machinery is put in operation that registers one for every ballot introduced. At the same time a bell is rung, thus notifying all within hearing that a ballot has been received. This multiplication of precautions is designed to prevent fraud. Thus every ballot had to show printed upon it the inscription upon the feeding wheel. This prevented the mixture of additional ballots. The total number introduced were recorded by the counting mechanism. This number was supposed to tally with the total number in the box. No ballot could be introduced surreptitiously, as the bell was arranged so as to ring for each rotation of the feeding wheel.

In practice, however, the box was found somewhat deficient. The men who had to manipulate it did not always possess the due degree of intelligence, and sometimes a deadlock was threatened. The ballot box company supplied instructors to teach the proper manipulation at three dollars per day. In some instances, it is said, the boxes were fully locked and the combinations were forgotten. In other cases the inspectors could not cope with the combination locks, and the keys alone were used. Sometimes the ballots proved too long to pass into the box at one revolution of the feeding wheel. This left two courses open to the inspectors. One was to leave the ballot between the rollers, and only to introduce it with the next one. This, of course, was objectionable. The other course was to turn the handle until it dropped into the box. This gave a double registry on the counter and two rings of the bell for one ballot.

All these troubles indicate that the box is far from being a perfect success. But it serves to indicate an advance, and certainly presents some excellent features. It would certainly seem that, with all its deficiencies, it would tend to secure the ballots from alteration or disturbance, and would operate to a considerable extent to procure a more perfect protection against fraud. All that can be said of it is that perfection has not yet been attained.

THE Reno *Journal* says that the practice of smoking opium is becoming almost as prevalent among the Pacific coast Indians as among the Chinese from whom they have learned it.

OTTO VON GUERICKE'S VACUUM GUN.

T. O'CONOR SLOANE, PH.D.

The ingenious old burgomaster of Magdeburg is renowned as the inventor of the air pump and as the originator of many experiments in natural philosophy. In his curious book on the Magdeburg experiments, a work published in the latter half of the seventeenth century, the experiment is illustrated, of which the one we here describe is a simplification. In many of his experiments on the pressure of the air and the effects of vacua, he first produced by the air pump a vacuum in a spherical vessel, and used the vacuum thus obtained for some operations conducted without or away from the air pump. In one instance he connected his exhausted sphere to the base of a cylinder which a piston tightly fitted. On opening communication between the two, the piston was held down by atmospheric pressure so as to resist the efforts of a very great number of men, who are depicted in one of the quaint wood cuts as attempting to pull it up. For his gun he adopted the same system. As he shows the apparatus, it is constructed of metal, with a large spherical vacuum chamber. As illustrated here, it is supposed to be constructed of glass, a round bottom flask maintaining the vacuum.

OTTO VON GUERICKE'S VACUUM GUN.

The experiment illustrates in an interesting manner the laws of momentum of solids and the atmospheric pressure. It is an example of the scientific work of over two hundred years ago. It is described in the same book in which the description of the Magdeburg hemispheres was first given. The version of it here shown is somewhat simplified. By atmospheric pressure, bullets are driven through a tube and out of its end with high velocity. The tube from which the bullets are projected is about three feet long. It may be made of metal or of glass. It must be of even diameter and have a smooth interior. Near its front end a short piece of tube is connected at right angles to it. This tube may be bent, but such bending is not absolutely necessary. The object of its curvature will be seen later. The other end of the long tube is slightly reduced in diameter. This should be as slight as possible, provided it is sufficient to prevent a bullet which fits the tube from falling out.

A round bottom flask is provided. It should be of three pints capacity for a tube three feet long by one-quarter inch diameter. A tightly fitting cork with a short piece of glass tube of the same size as the piece projecting from the longer one is adapted to the flask. A rubber connecting tube with pinch cock, a plug of wood fitting the end of the projecting tube, and some bullets, complete the apparatus. The plug should be secured by a short cord, to prevent its loss when the bullets are discharged. It must fit air tight, yet be easily expelled. This result is best secured by giving it a conical shape or by inclining the sides considerably. The bullets should fit the tube so as to run up and down it freely, yet should not have much windage.

To perform the experiment, a vacuum is first produced in the flask. To do this a little water is introduced, the cork is put in place in its neck, the rubber connecting tube is slipped over the tube passing through the cork, and the pinch cock is removed or wedged open. The water is now heated until it boils. After a few minutes' ebullition, steam will issue from the rubber tube. When this has continued so long that it seems certain that all the air is expelled—five minutes should be enough—the pinch cock is put in place and tightly closed, and at the same instant the flask is removed from the source of heat. It is allowed to cool. The cooling may be accelerated by pouring cold water over it, or by dipping it into the same. It is now connected to the long tube as shown. If the projecting tube to which the rubber one is joined were straight, there would be danger that the bullets would drop into it or even into the flask. It is therefore better to have it curved.

Two or three bullets are now introduced and allowed to roll down to the lower end of the projection tube, whence they are prevented from escaping by the slight contraction already spoken of. The plug is put into the other end, and all is ready. The tube is pointed in such a direction that the escaping bullets will do no harm, and the pinch cock is suddenly opened to its full extent.

The air at once rushes into the flask from the lower end of the tube, driving along with its current the bullets. With a pressure of nearly fifteen pounds to the square inch to actuate it, the air enters the flask with high velocity. The bullets go along with the current as far as the communicating tube that leads into the flask, and then, owing to their high momentum, rush past the opening, strike the end of the plug, expelling it from its place, and fly out of the tube. This is all done in an instant, of course. The bullets pass through the tube and are driven out with such velocity that the eye cannot follow their course. They can be projected thus to a great distance. They may even possess sufficient energy to pierce pasteboard.

A simpler way of illustrating the experiment is to use the long tube with bullets and plug alone, the mouth and lungs producing the suction. By placing one or two bullets in the

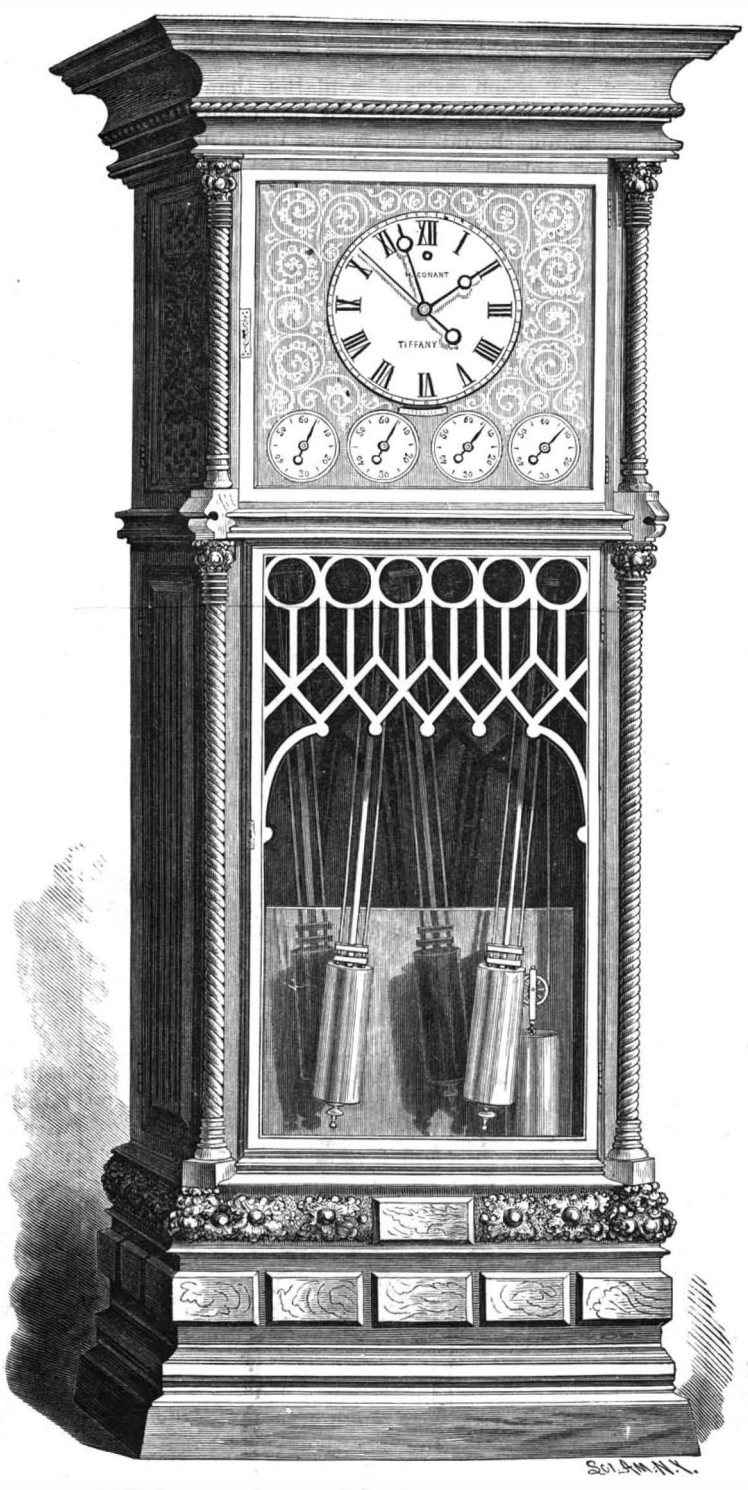


Fig. 1.—CONANT'S ISOCHRONAL CLOCK.

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lower end, inserting the plug in the upper, and giving a quick, strong inspiration, the bullets may be easily thrown fifty feet. But out of compliment to the burgomaster, and in order to see the experiment in its perfection, the vacuum method should be adhered to.

NEW ISOCHRONAL CLOCK.

There is some doubt as to when the first clock was made, but historically we find mention of the production of a clock in 1232. All of the early clocks subsequent to this show a great inventive skill and wonderful constructive ability; but until the discovery of the isochronal property of the pendulum by Galileo, the mathematical investigation of the pendulum by Huygens, and the adaptation of the pendulum to the regulation of the motion of the clock by Harris, about 200 years ago, nothing like a perfect time-keeping clock was known.

Probably no single machine was ever made in so many forms or in so great numbers, nor at so small cost, considering the great number of parts, the accuracy with which the parts are made, and the care with which they are assembled. Of course the great majority of clocks only approximate accuracy. A few are reasonably accurate, but even these have errors which must be compensated.

Recognizing the fact that an absolutely perfect clock did not exist, Mr. H. Conant, of Pawtucket, R. I., has devised and patented a clock in which an average of time as kept by a number of pendulums and escapements of the most perfect construction is indicated by the main hands and dial. This clock is shown in the annexed engraving. It is a fine piece of mechanism, made by Tiffany & Co., of this city.

This clock is provided with four pendulums and four escapements arranged in pairs, as shown in Fig. 2. Each pair of scape wheel arbors carry pinions, which engage in the large spur wheels, which are placed loosely on their supporting shafts, and act as intermediates to transmit power from the main train to these several escapements. Fig. 3 shows in detail the arrangement of these wheels. Power is received by the middle wheel, B, and it is transmitted to the wheels on each side of it by means of the little planetary bevel wheel, C, which is fixed with its axis radially to the supporting shaft, and is carried around as the wheel, B, revolves. This arrangement will allow one of the pinions being stopped, or to move at a speed different from the wheel, B, or its mate on the opposite side of B, and is known to mechanics as a compound or differential gearing. In this case it acts to average the motions of the side wheels, A A, into the middle wheel, B, for it will be seen that if another pinion wheel be acted upon by the wheel, B, that this pinion would move at the average speed of the pinions driven by A A, which is the half of the speed of each added together. Then calling the assemblage of wheels in Fig. 3 an intermediate mechanism, it will simplify the description to say that the second pair of pendulums and their escape wheels receive their impulse by a duplicate mechanism, and that these two pair of pendulums are impelled by a third mechanism, whose central wheel is impelled by the pinion on the shaft of the sweep seconds shaft on the main dial, said pinion being a part of the main train, which is made correspondingly heavier and stronger, and is driven by a heavier weight than ordinary, inasmuch as the four escapements require four times the weight to give them proportionate effect. Thus it will be seen that the seconds hand of the main dial moves at an average of that of the four pendulums, and responds to the ticks of each.

To show fully the action of the clock, we will suppose that it is all ready to run, and the seconds hands, both of the pendulums, and the main dial are all set at 60 or zero, and the pendulums are at rest. We will now start pendulum No. 1. The pendulum ticks seconds, and the second hand of that escapement will revolve once in exactly one minute. But the seconds hand of the main dial, although it responds to the ticks of that pendulum, only moves forward one-fourth of a second, and will not complete a revolution until the first has made four revolutions. This shows that the value of the ticks of each pendulum is but a quarter of a second to the main seconds hand. Now, in corroboration, starting another pendulum will increase the speed of the main hand by another equal factor, and three pendulums moving will give three-fourths speed, while the four will impart a speed equal to one-fourth of each added together, consequently an average of the speed of all.

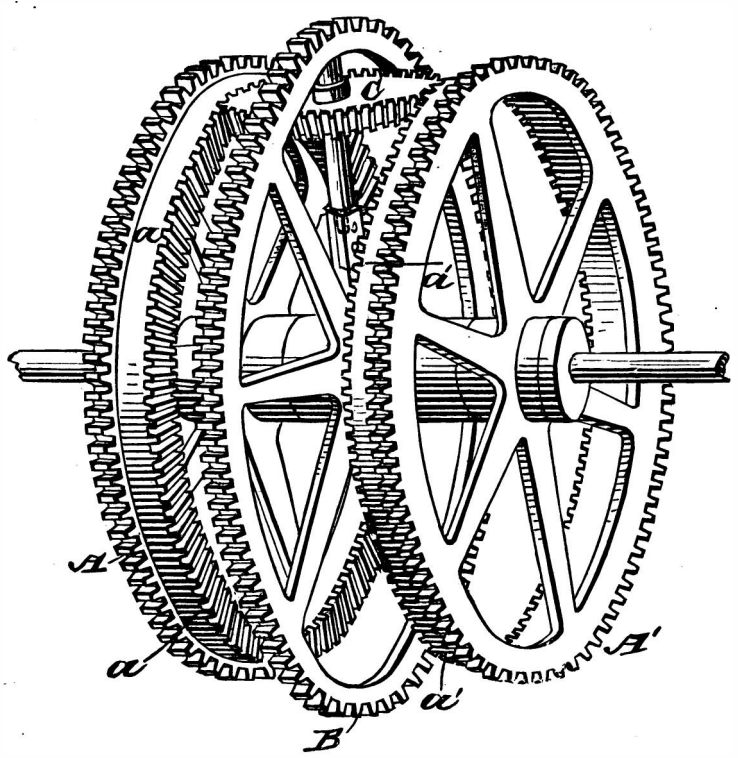

Fig. 3.—THE AVERAGING WHEELS.

To give room, the clock is made rather wider in its case than ordinary, and two pendulums are in front and two are in back. A plate of thick glass is put between the front and back pendulums, and is intended to cut off any sympathy caused by the motion of the air.

This clock is much easier of regulation than the ordinary clock, for the reason that it is not necessary that each pendulum should keep correct time, but that it should have a steady rate, and if it is too fast, it is corrected by another going correspondingly too slow; and the inventor believes that pendulums will have a steadier rate when thus associated than when isolated, quality and other circumstances being equal.

It will be readily understood from this description that these instruments can be made with two, four, eight, or even sixteen pendulums, or marine escapements, as desired for accuracy. This one here described was made for the purpose of exemplifying the invention and testing the workings of different compensating pendulums.

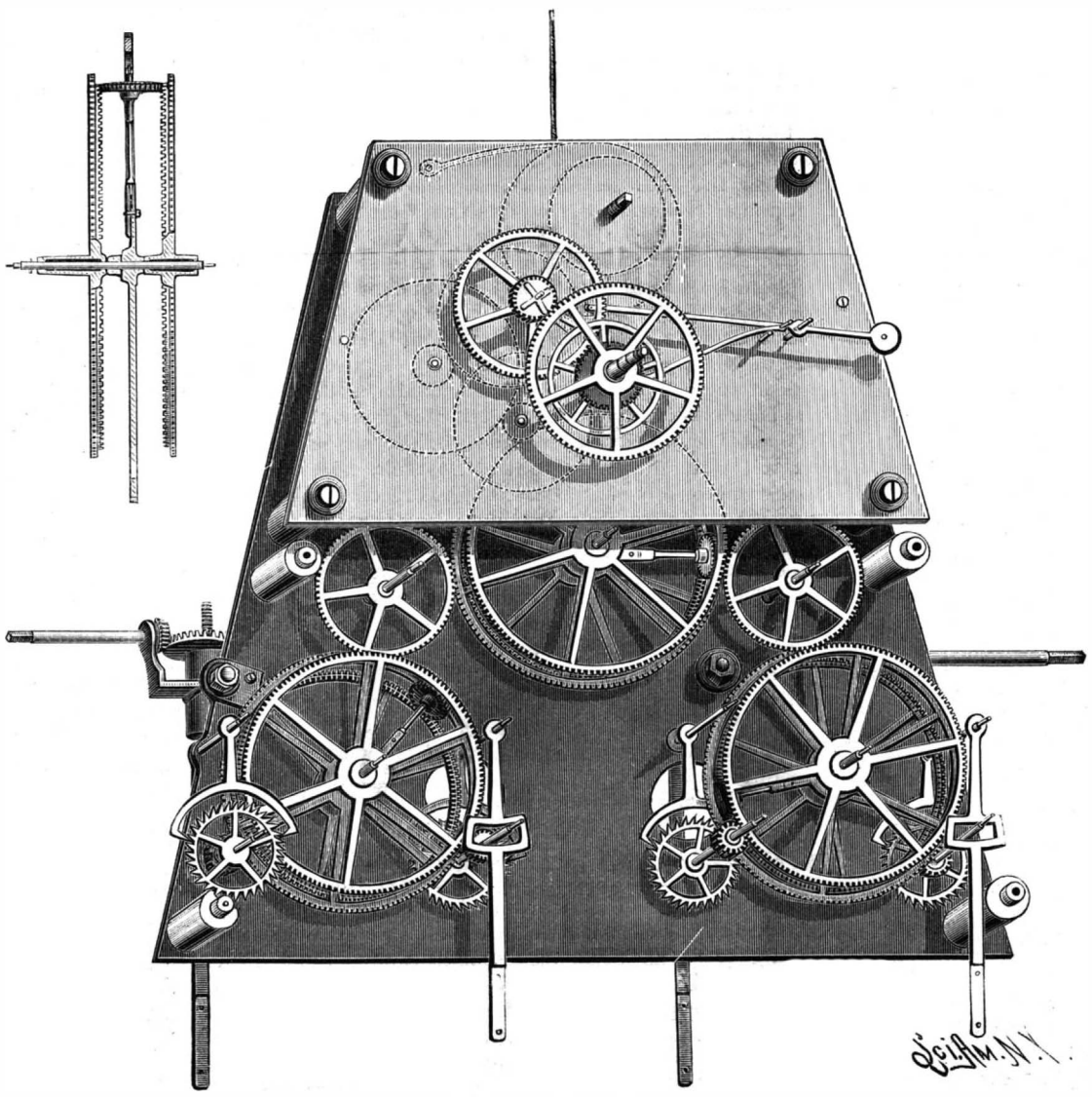

Fig. 2.—TIME AVERAGING MECHANISM OF CONANT'S CLOCK.

New Secondary Battery.

A new type of secondary battery was employed on the electric launch recently tested by the French naval authorities at Havre. The inventor is a M. Desmazures, and the cell is constructed as follows: A cylinder of tin plate forms at once the containing vessel and a portion of the negative electrode, which is a sheet of the same material. The positive electrode is made from a plate of porous copper, obtained by subjecting the metal in a state of powder to a pressure amounting to several tons on the square inch. This plate is separated from the negative element by a partition of parchment paper supported on glass rods, the object being to prevent copper oxide reaching the negative element and causing a film of metallic copper to be there deposited. The cell is filled with a mixed solution of zincate of soda and sodium chlorate, and is then hermetically sealed. The charging is effected in the usual way, the result being a deposition of metallic zinc on the negative electrode, which is redissolved on discharging. The number of cells used at Havre was 132, which furnished a current of from 87 to 89 amperes under a difference of potential of 100 to 104 volts, and the weight per horse power per hour was about 73 pounds.

Wild Geese in Dakota.

A traveling correspondent now in central Dakota says they had a cold snap there in the latter part of October, when the temperature quickly fell to 12° F. below zero. One curious effect of the cold was to bring down immense flocks of wild geese. Seen from the car windows, when they alighted on the stubble fields they looked like great snow banks, covering many acres of ground. Mr. Goose unlike Mr. Buffalo seems to augment in numbers. They are exceedingly shy and difficult to shoot. The best way to capture them is to dig a pit near where they feed, stick up two or three dozen decoys made of sheet iron painted up, and when a flock flies over they come down out of curiosity. If a man is sunk in the ground up to his shoulders, they don't recognize him. Another way is to approach a feeding flock with a team of horses, of which they are not shy. They don't seem to see a man if he remains in a wagon. Skirt the flock as close as possible, then suddenly turn and run the horses straight for them at top of speed. They rise slow, and one can get directly under, oftentimes, and bang away with results.

Two men brought fifty-seven in half a day. They are fine, large game, about the size of domestic geese, and nice eating.

Artesian wells are growing quite fashionable in this central part of Dakota. I meet them quite often. Any town that makes any pretense to be a town must now have its artesian well. They all seem to be about 900 to 1,100 ft. deep, and cost from about $3,500 to $4,000 each, with a pressure of 180 to 200 lb. to the square inch. W. Y. B.

Ostriches.

A correspondent at Cape Colony, South Africa, writes us as follows: A curious habit of these birds was witnessed on the farm Guilford, in the Queenstown district, by the proprietor and some of his family and servants during the late rains.

The nest, which is merely a large, flat, saucer-like hole in the ground, became flooded; and when the water did not directly drain off, the two parent birds began to drink it up till the nest was drained dry.

The poor hen bird was so full that she seemed quite sick; the cock, however, drank his full share as in duty bound, being the most assiduous in all matters pertaining to the incubator, always sitting on the eggs himself by night.

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The Isolation of Fluorine.

This recent scientific achievement of M. Moissan has been made the subject of a report to the Chemical Section of the French Academy, which, according to *Engineering*, sets forth the work of preceding chemists leading up to the late discovery. From this it appears that Scheele and others taught us how to prepare fluoric acid, and Davy attempted to isolate fluor, or fluorine, as he called it. Since Davy's attempt several others have tried it by electrolysis, some of these injuring their health in the process. M. Moissan succeeded by the electrolytic method, and came to the conclusion that the gas which is disengaged at the positive pole by electrolysis of anhydrous fluorhydric acid is fluor. This conclusion has been justified by the report of the above mentioned committee. This gas was found to have the following properties: It is completely absorbed by mercury, with the production of protofluoride of mercury; it decomposes cold water, disengaging ozone; phosphorus burns in it, producing fluoride of phosphorus; sulphur warms, melts, and even flames in it; iodine is transformed in it to a colorless gaseous product; antimony and arsenic in powder burn in it; crystalline silicium takes fire and burns in contact with it, producing fluoride of silicium. Adamantine boron burns in it with greater difficulty. Carbon seems unaffected, but iron and manganese in powder burn in it with sparks. It attacks most organic bodies with violence; alcohol, ether, benzine, turpentine, and petroleum take fire in contact with it; and fused chloride of potassium is attacked, cold, by it, with disengagement of heat.

Edison's Improved Phonograph.

We recently gave some account of this, but the following report of an interview with Edison by a *World* reporter contains additional particulars which are both curious and interesting. In answer to about two hundred questions, more or less, Mr. Edison said:

"Perhaps I am wrong in telling you anything about my phonograph, because what I claim for it is so extraordinary that I get only ridicule in return. I am so confident that when the apparatus appears it will dispel all doubts as to its practicability and working value that I can afford for the present to ignore all kinds of criticism and keep at my work regardless of the storm which I have been raising by telling a few people that there was such a thing as a perfected phonograph in existence. I am sure that while scientific men may doubt that I have succeeded as well as I say I have, they will admit that there is nothing at all impossible in what I claim, and that the germ of the perfected phonograph, should such a thing appear, is very clear in my old toy of ten years ago, which was exhibited all over the country, and was then acknowledged to be one of the wonders of the century. Just consider for a second what my old phonograph is, and think how little needed to be done to bring it to a working instrument. With my roughly constructed instrument of 1877 I reproduced all sorts of sounds, getting back from the phonograph something like the original sound. Of course, you had to yell into the thing, and the reproduction of conversation was often something of a caricature of the original. Nevertheless, to obtain a result that could be understood was doing wonders, and most people who remember my exhibitions will admit that while I did not produce a commercial machine, I made a very interesting and creditable attempt, and my whistling and singing phonograph was a wonder.

"There were all sorts of objections in detail to my first instrument. It weighed about one hundred pounds; it cost a mint of money to make; no one but an expert could get anything intelligible back from it. The record made by the little steel point upon a sheet of tin foil lasted only a few times after it had been put through the phonograph. I myself doubted whether I should ever see a perfect phonograph, ready to record any kind of ordinary speech and to give it out again intelligibly. But I was perfectly sure that if we did not accomplish this, the next generation would. And I dropped the phonograph and went to work upon the electric light, certain that I had sown seed which would come to something. For ten years the phonograph has come up in my brain automatically and almost periodically. I would turn it over and over mentally when I had nothing else to think about. When I couldn't sleep at night, when traveling, when worried about business affairs, I would think the phonograph over and jot down any new ideas for future experiments. Eight months ago I began laboratory work upon it again, and a month ago I stopped because I could see no further improvement to be made. It is a finished machine—simple, cheap, effective, not liable to get out of order, and it does everything that I ever hoped the perfected phonograph might do.

"My phonograph will occupy about as much space on the merchant's desk, or at the side of the desk, as a typewriter does. It will work automatically by a small electric motor, which runs at a perfectly regular rate of speed, is noiseless, and starts or stops at the touch of a spring. Suppose the merchant wishes to write a letter; he pulls the mouthpiece of the phonograph to him, starts the motor with a touch, and says what he has to say in an ordinary tone of voice. When he is done, he pulls out a little sheet and rolls it up for the mail. The recipient places this sheet in a similar phonograph, touches the motor spring, and the instrument will at once read out the letter in a tone more distinct, clearer, more characteristic of the voice of the writer than any telephone you or I ever heard. The phonograph voice is not a loud voice, perhaps not more than twice as loud as the sound you get from a good telephone, and an earphone will be necessary. This, however, may not be an objection, inasmuch as people do not always want to have their letters heard all over the office. In aiming for loudness in the phonograph, I went astray in my first experiment. I should have tried for clearness. The present apparatus will satisfy any one who is half satisfied with the telephone. Of course, there are no disturbances in the phonographic message such as those made by induction along a telephone wire; and as the apparatus will repeat the letter over and over again, it is possible to understand every syllable, even in a noisy office. I was so overcome with the success of my first instrument, finished about six weeks ago, that I doubted whether I could make another equally good, and I went to work at once to do so. My second instrument works as well as the first, and I have forty workmen employed in making the tools for the manufacture of the first lot of 500 phonographs. They will cost $60 apiece.

"Now for some speculation as to what people may do with the phonograph. I am confident that it will be found in the office of every busy man. I am confident that the editor and the reporter of the future will never think of losing time by writing with a pen or dictating to a stenographer when the printer can set type better from the dictation of the phonograph than he can from copy. I have already perfected an apparatus which allows the phonographic message to be given out in pieces of ten words each. The printer touches a pedal with his foot, and the phonograph says ten words. If he sets the ten correctly, he touches the pedal again and gets ten words more. If he is in doubt he tries another pedal, which makes the phonograph repeat. In the future some method may be found of combining the phonograph and the telephone—that is to say, the phonograph may be made so delicate as to take down the sound from a telephone and give it out again when wanted. As yet I have not attempted any such thing. The vibrations of the telephone diaphragm are too delicate for use in the phonograph. In business I think that the phonograph will be used everywhere. Outside of business it is hard to say exactly to what uses it may be put. As it will record and repeat any kind of musical sound, and as the process of duplicating the phonogram, as I call my sheet of metal which has passed through the phonograph and become impressed with certain sounds, is very cheap, the phonogram copy of a lecture, a book, a play, or an opera need cost but a trifle.

"For music I know that you will simply laugh when I tell you what I have done with the two instruments that I have finished. I have got the playing of an orchestra so perfectly that each instrument can be heard distinct from the rest. You can even tell the difference between two pianos of different makes; you can tell the voice of one singer from another; you can get a reproduction of an operatic scene in which the orchestra, the choruses, and the soloists will be as distinct and as satisfactory as opera in this sort of miniature can ever be made. Opera by telephone has been done in Paris and London more or less successfully, but the phonograph will eclipse the telephone for this purpose beyond all comparison, and phonographic opera will cost nothing, because the phonogram can be passed through the phonograph, if necessary, a thousand times in succession, and once the machine is bought there is no other cost beyond the trifle for phonograms. For books the phonogram will come in the shape of a long roll wound upon a roller. To make the first phonographic copy of a book some good reader must of course read it out to the instrument; once that is done, duplication to any number of thousand or million copies is a simple mechanical work, easy and cheap. Now, just think a moment what that means.

"Suppose you are sick, or blind, or poor, or cannot sleep. You have a phonograph, and the whole world of literature and music is open to you. The perfected phonograph is going to do more for the poor man than the printing press. No matter where he is, the poor man can hear all the great lecturers of the world, can have all the great books read to him by trained readers, can hear as much of a play or an opera as if he was in the next room to the theater, and all this at a cost scarcely worth mentioning. I remember that when the telephone was first announced it was said that now people in the wilds of Africa or America might assist nightly at the performances of the Paris Opera House. The wires from that favored spot might run to all parts of the world. Well, we have not yet got to that, though it is a scientific possibility for the future to perfect in detail. But the phonograph will make such a thing perfectly easy. The phonographic record of a performance at the Paris Opera House can be duplicated by the thousand and mailed to all parts of the world. I don't know but that the newspaper of the future will be in the shape of a phonogram, and the critic will give his readers specimens of the performance and let them hear just how the future Patti did her work, well or otherwise. This sounds like the wildest absurdity, and yet, when you come to think of it, why not? Have I told you enough to make you believe that I am joking? Well, I am nothing of a joker, and this is all the most sober kind of statement. Within two months from now the first phonographs will be in the market."

The reporter to whom Mr. Edison told all this in his usual earnest and quiet manner asked several expert scientists what they thought of it. Not one was found who was willing to say that there was anything impossible or even improbable in what Edison claims to have done. The points of detail mentioned as difficulties about which Edison had said little or nothing were, first, the scarcity of good small electric motors, perfectly regular and perfectly noiseless; secondly, the difficulty of making a recording sheet for the phonograph which would not wear out when passed through the instrument a great many times. This was one of the old troubles of the first phonograph. Edison says that he has made a perfect motor and also a perfect material for his phonograms, but as yet he will not show either to outsiders.

How to Copy Photographic Magic Lantern Slides.

A correspondent in the *English Mechanic* suggests the following mode for making magic lantern slides. We submitted the article to an experienced photographer, who expresses some doubt as to its working satisfactorily, but at the same time he recommends amateur photographers to try the receipt, and if not found satisfactory, that they experiment with other ingredients or the same substances in other quantities until they discover a better process.

The process is known as the "blacklead" process, and the principle of it is that gum arabic becomes insoluble when placed in contact with white light. The following ingredients must be mixed carefully, and allowed to remain 24 hours before using:

Gum arabic	60 grains.
Glucose	45 grains.
Glycerine	10 minims or drops.
Water	2 ounces.

When well melted add (in a dark room) 30 grains of potassium bichromate.

A glass plate, the size of the slide about to be copied, is well cleaned and coated (in the dark room) with the above solution. When quite dry, it must be well heated previous to exposure in the printing frame. The exposure of this sort of plate, like any other, can only be found by experience; for, of course, a great deal depends on the density of the photograph and the brightness of the light. This process differs from ordinary photography in this way: In photography a positive will give a negative, and *vice versa*. In this process a positive gives a positive and a negative a negative.

Having exposed the plate for a sufficient length of time, you now develop by brushing over it with a large camel's hair brush the finest blacklead. It will now be observed that that part of the plate which saw most of the light will be insoluble, and the blacklead will not stick there; but on that part of the plate which saw no light the gum arabic will be soluble and the blacklead will adhere. To get the photograph dense enough, you will have to keep rubbing in the blacklead for a considerable time. Having developed it sufficiently, you now pour on some thin collodion, so that every part will be covered, and then tilt the plate up on one side to drain. When well drained dry well, and then wash in clean cold water for two hours. Remember that without the collodion the picture will fade away when put in water, and that the plate must be washed until the collodion is perfectly dry.

The reason that you wash the plate after collodionizing is that all the potassium may be removed. When completely finished, it is a good plan to cover the side with the photograph on it with a piece of clear glass to protect it, binding the two together with an edge of black paper—needle paper is the best.

Destruction of the Phylloxera.

Dr. Clemm has patented the following process in most civilized countries:

He incorporates with the soil sulphides and carbonates which easily undergo decomposition, preferably those of potassium. Peat which has been made to absorb sulphuric, nitric, or phosphoric acid is then also introduced. The acid gradually acts upon the sulphide and the carbonate, liberating sulphureted hydrogen and carbonic acid in the soil. These two gases, according to the experiments of Dr. Eyrich, of Mannheim, are rapidly and uniformly distributed, and prove fatal to the *Phylloxera* in its underground stage, as well as to Colorado beetles, field mice, moles, etc. The potash remains in the soil as a sulphate, nitrate, or phosphate. The question is whether useful animals, such as earthworms, humble bees, carnivorous ground beetles, etc., will not be destroyed also.

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THE VOLCANO OF KLUCHI OR KLUCHEFSKAYA, KAMSCHATKA.

Kojerevsky—a village of ten huts and sixty-three inhabitants—lies at the foot of Uskovska, a mountain of nearly 13,000 feet, whose summit from this aspect presents the appearance of a uniformly rounded dome of snow. It is in reality twenty-three miles off as the crow flies, but the giant scale on which nature works in these regions belittles space to an extent that is inconceivable until the hard facts of actual measurement are before one. A little farther to the south and east is Kluchi, whose sharp peak rises to a vertical height of 3¼ miles above the river, guarded on the right by Kojerevska, which is inferior to it in altitude by 1,500 feet.

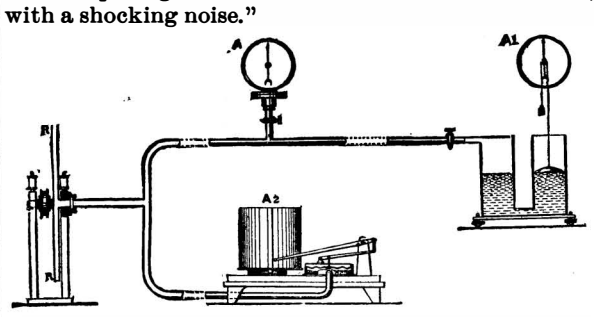
The sun was setting as we rounded a corner and came in sight of the village of Kluchi, its smoke hanging as a blue haze in the still evening air. To our left, the Harchinska Mountains, furrowed with deep gorges, looked almost black against the amber sky. The huge cone of Kluchi caught the last rays of the sun and flushed a pale pink, while at the lip of the crater a fleecy puff of smoke hovered for an instant as if in doubt, and then floated out a long thin streamer to the east. Around his shoulders hung a thick belt of cloud, gathering rapidly with the fast approaching night, and beneath, slope after slope rose steadily up to meet the pyramid above.

The morning of September 13 broke with hardly a cloud, and the view of the mountains, which now lay nearly due south of us, was magnificent. The even slopes of ruddy vegetation rise smoothly upward till, at the height of two or three thousand feet, the snow is reached. The outline of the mighty volcano was as perfect here as before, and its exquisitely graceful slope as unbroken. Near the summit, on the side immediately facing us, a deep furrow, as yet untouched by the rays of the morning sun, showed the remains of some past eruption—a huge scar which the snows of many winters had done their best to obliterate. From the crater light puffs of smoke drifted slowly away to the east, far whiter than the snow which lay below, for on all sides, and especially near the summit, a sprinkling of ashes had dulled its purity almost to a gray. The rounded half dome of Uskovska to the west showed a vast field of unbroken snow, and on the side toward Kluchefskaya appeared to have been completely blown away by some great eruption in past years, leaving a huge open crater, the western walls of which alone were standing. The upper part of these, which was all that we were able to see, seemed to be almost vertical upon the inner face. Between the two mountains was a lesser cone, which, like Uskovska, appeared extinct.

We had an excellent opportunity for taking observations on the heights, the river forming a good base. We accordingly took advantage of it, and from the results of this and other work the following may be given as fairly accurate altitudes for the four chief volcanoes lying to the south of the lower part of the Kamschatka River: Kluchi or Kluchefskaya, 16,988 feet; Uskovska, 12,508 feet; Kojerevska, 15,400 feet; Tolbatchinska, 11,700 feet.

We were informed that an eruption of Kluchi had occurred in 1879. The mountain is always more or less in a state of activity, but on the morning of August 14 dense clouds of smoke appeared above the crater, and at midday the sky was as dark as night. Before long ashes began falling, and in a few hours the ground was covered with them to the depth of three inches. There was no earthquake, but on the following morning a small stream of lava poured from the lip of the crater on the north side. It descended but a short distance, however, and, shortly after, the mountain returned to its usual state of threatening quiescence. With this exception there have been no eruptions within the memory of man, or at least none of any magnitude. A few ashes often fall, and had done so not long before our visit, but the recent falls of snow had done much to hide them.

Kluchi appears to have been still more active in the middle of the last century. Krasheninikov says that "it throws out ashes twice or thrice yearly, and sometimes in such quantities that for 300 versts around the earth is covered with them to the depth of a vershoke (nearly two inches). From the year 1727 to 1731 the inhabitants observed that it burnt almost without interruption, but they were not under such apprehensions as in the last conflagration in the year 1737. This terrible conflagration began the 25th of September, and lasted one week, with such violence that to the people who were fishing at sea near the mountain it appeared one red hot rock, and the flames which burst through several openings sometimes showed like rivers of fire, with a shocking noise."



RUNG'S PNEUMATIC SPEED INDICATOR.

On the 6th of October there was an earthquake of tremendous violence in the Avatcha district and the southern point of Kamschatka, regions which, it should be observed, lie in a direct line between Kluchi and the volcanic chain of the Kuril Islands. An enormous tidal wave occurred, "overflowing the shore 200 feet high," and killing many of the inhabitants; but the country in the immediate neighborhood of the volcano did not appear to suffer much, although a violent earthquake was experienced at Nischni Kamschatka on the 23d of the same month.

In 1762 and 1767 outbursts again occurred, though of very much less severity, but subsequent to that time no accounts of other eruptions have, as far as I am aware, been published, with the exception of that of Professor Adolph Erman, who, in 1829, found the peak "in picturesque and sublime activity, and approached the burning lava, which poured forth a continuous stream," till he reached the height of 8,000 feet above the sea.—*Dr. F. H. H. Guillemard, Cruise of the Marchesa.*

MRS. HARDWICKE, widow of the founder of "Science Gossip," preserves eggs by carefully oiling them with a soft brush all over and packing them in jars with plenty of bran between each layer. A thick brown paper should be tied over the mouth of the jar when it is full. "When eaten at three months old," she says, "you could not tell them from fresh eggs."

KLUCHI OR KLUCHEFSKAYA, VOLCANO, 16,988 FT., KAMSCHATKA.

PNEUMATIC SPEED INDICATOR.

This indicator is the invention of Captain G. Rung, of the Danish artillery, and has already been in use for about a year and a half in the Danish navy, where it seems to have given great satisfaction. The principal merit of this invention lies in its extreme simplicity and consequent cheapness and non-liability to get out of order. The apparatus consists, first, of a rotating tube acting as a centrifugal exhauster. This is connected with a pipe leading to an indicator, by which the air pressure within the pipe is made to exhibit the number of revolutions per minute of the exhauster. Several different forms of indicator are made, and in the adjoining illustration three independent methods are shown. In this figure, R R is the rotary tube, which is driven from the shaft of the dynamo or other machine. A is an indicator, constructed precisely on the principle of the aneroid barometer, and of which, therefore, no further description is necessary. The scale is calibrated, so as to be read directly in revolutions per minute. Another form is indicated at A_1, in which a U tube containing water is employed, one branch being connected with the rotating exhauster and the other remaining open to the atmosphere. The difference of pressure in the two limbs, which is proportional to the speed, is indicated, as in the ordinary mercurial barometer, by means of a float attached to a cord passing over a pulley carrying an index hand, and which is counterbalanced by a weight. This is a very sensitive and also a very accurate arrangement. Evaporation is compensated for by means of a small plunger, not shown in the figure, by adjusting the position of which the needle may be set to zero at any time. A_2 represents a recording arrangement, in which the point of a bent lever traces a line upon a sheet of paper wrapped on a cylinder, which is rotated by clockwork. The position of the lever is determined by the degree of exhaustion in an aneroid chamber.

In addition to the advantages already named, there are two important features which may be said to be almost peculiar to this system. It permits of an accurate indication of the speed of any class of machinery at any distance from the machine itself. And a single indicator may be applied successively to any number of rotators. It is usually sufficient to have only one indicator connected with a common reservoir, to which the pipes from the rotators can enter through stop cocks. The latter feature is of course an admirable one from the economical standpoint.—*The Electrician* (*London*).

Electrolytic Inlaid Work.

This class of work in metal decoration can be executed by aid of the electric current in the following way: The plate of copper which is to receive the inlaid design is dipped into melted wax, so as to receive a thin coat of it, and the design is drawn through the wax, so as to leave the copper perfectly exposed in the lines. The plate is now connected with the positive pole of a battery, and a second copper plate is connected with the negative pole, and both plates are suspended in a solution of sulphate of copper. Under the action of the current, the copper of the first plate is attacked and dissolved where the lines were drawn through the wax, so as to produce an etching of the design on the surface, while an equivalent of the copper is deposited upon the other plate. When the design has been etched about 1 mm. (one twenty-fifth inch) in depth, the plates are removed from the bath, by a few drops of hydrochloric acid the sulphate of copper solution adhering to the lines is removed, and the plate is washed in pure water. Next, the same plate is connected to the negative pole of the battery, to whose positive pole a plate of platinum is connected, and the plates are suspended in close proximity to each other in a nickel or silver bath. The reverse process now takes place. According to the solution employed, metallic silver or nickel is deposited in the lines etched in the copper following the design inscribed in the wax, and this operation is prolonged until the lines are perfectly filled up. The wax coating is readily removed by a wooden scraper and by washing with alcohol. This gives upon the copper surface a design in inlaid metal, either silver or nickel, which in beauty and durability surpasses any produced in other ways.—*Centralblatt fur Opt. und Mech.*

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Do we Own Behring Sea?

The brief filed at Sitka by the counsel of the United States government shows to what extent the State department is prepared to go in maintaining our claim of exclusive jurisdiction over Behring Sea east of the line established by the treaty of 1867 as the boundary between Russian and American waters in the North Pacific.

The British sealers were seized at a point in Behring Sea about 130 miles north of the island of Ounalaska, the nearest land. They are prosecuted under a section of the revised statutes which provides that no persons other than those licensed by the government shall kill any fur-bearing animal "within the limits of Alaska Territory or in the waters thereof." The defense, of course, is a denial of the United States' jurisdiction in Behring Sea beyond the marine league belt recognized by the common law of nations.

This controversy opens the most important international question with which the United States is at present concerned. In view of the importance of the principle and the magnitude of the sea area involved, the century-old headland question of the Atlantic fisheries becomes insignificant in comparison. The United States asserts the doctrine that from the chain of Aleutian Islands up to Behring Strait the waters of the North Pacific Ocean are landlocked and belong exclusively to us, with the exception of a narrow strip along the Asiatic coast; and that we have the same dominion over them as over the waters of Lake Michigan, or of Chesapeake Bay, or of Long Island Sound.

The sea area covered by this most important and interesting claim is about three times as great as the entire Gulf of Mexico. Roughly speaking, it is equal to the Mediterranean, the Adriatic, the Ægean, and the Black Seas combined. Take a map of the world on Mercator's projection, and draw a line from the middle of Behring Strait southwesterly to a point midway between Attou Island, the westernmost of the Aleutian archipelago, and Copper Island, just east of Kamschatka. That represents the line of demarkation precisely stated and established by the treaty ceding Alaska to the United States. The triangular body of water inclosed by this imaginary frontier on the northwest, by the chain of the Aleutian Islands on the south, and on the east by the coast of Alaska proper, forms the "inclosed sea" over which the State department claims exclusive dominion for the United States.

Attou Island, the westernmost point of United States territory, is in the longitude of New Zealand. It is actually further west of Sitka than San Francisco is of New York. Attou is as far west of New York as New York is west of Trebizond or Moscow. More than a hundred miles beyond this island, in the open Pacific waters, is the western limit reached by the laws which Congress makes—that is the claim.

Can we shut the world out of Behring Sea? Is that body of water really an inclosed sea, an inland sea, in the sense recognized by the international code? In selling Alaska to us, had Russia the right to convey also exclusive dominion over this vast region of brine? These are the points involved in the controversy about the British sealing schooners seized by our revenue cutters in order to protect the business of our tenant, the Alaska Commercial Company. It appears that our government is preparing to answer all of these several questions unqualifiedly in the affirmative.

The one vital point in the brief prepared by Mr. A. K. Delaney, counsel for the United States in the cases of the captured British sealers, is the argument that in the treaty settlement between Russia and Great Britain in 1825, Russia's dominion over Behring Sea was not challenged by Great Britain—in other words, that it was tacitly recognized. Nevertheless, the question is in a shape that admits of widely different constructions. "If a sea," says Vattell, in his treatise on the Law of Nations, "is entirely inclosed by the territories of a nation, and has no other communication with the ocean than by a channel of which that nation may take possession, it appears that such a sea is no less capable of being occupied and becoming property than the land, and it ought to follow the fate of the country that surrounds it."—*New York Sun.*

Steam Heating for Railroad Cars.

The sure approach of colder weather has, we are glad to notice, revived the question of heating our railroad cars by other means than the outrageously dangerous coal stove. Public sentiment, irritated by the several holocausts of last winter, naturally demanded a change, and several of the State legislatures made laws compelling such change. So far this is good, and several of the railroads have already arranged for the introduction of a safer means of heating their passengers. Most of the attempts so far have quite naturally looked to steam as the easiest solution to the heating problem, but there is considerable difference in the divers systems as to the mode of application and source of supply.

The Pennsylvania Company is reported to have successfully solved the problem, so far as its future on the question is concerned, by taking the steam from the locomotives, and gradually extending its experiments until eight cars are easily, safely, and comfortably warmed; and it is stated that the intention of the company is to apply it to several of its best trains as soon as possible and then continue its development.

This solution is perhaps as good as could be obtained, provided that the cars were warranted always to be in conjunction with a locomotive, and the said locomotive warranted always to be in proper working. But, as the *Railway News* suggests, accidents will happen, and if no other means of heating the cars is provided for, what is to become of the passengers if an accident happens to the locomotive? They may possibly freeze to death if the eventuality is not otherwise provided for. In most cases of accidents, railroad men know that it is just the locomotive which runs the greatest danger. The system to be generally adopted must provide for this eventuality, and if its steam is obtained from the locomotive, it must have some secondary source of supply, individual to the car itself and applicable when required.

Complementary Colors.

J. G. Crace, in *The Architect* (London), repeats as follows what most people know, but some do not:

All colors have their complementaries, which add to or detract from the beauty of the adjoining colors, according to what they may be. Thus, the complementaries of red are green; blue are orange; yellow are violet. If you cut out pieces of gray paper in an ornamental form, and stick a piece on each of the three colors I have named, you will find, in a shaded light, the gray will be fully tinted by the complementaries of these colors. But you cannot lay down precise rules. An experienced artist can bring any two colors together by properly modulating them. Nothing is so charming and so refreshing to the eye as an harmonious arrangement of colors. They are "like a sweet chord of music to the sense." The hand of nature never errs, whether it brings together scarlet and crimson, as in the cactus; scarlet and purple, in the fuchsia; yellow and orange, as in the calceolaria; or the colors in the varied plumage of exotic birds—the harmony is always beautiful, ever perfect. The laws of harmonious coloring are a necessary part of the knowledge of the manufacturers of colored fabrics. I will suggest a few contrasts:

1. Black and warm brown. 2. Violet and pale green. 3. Violet and light rose color. 4. Deep blue and golden brown. 5. Chocolate and bright blue. 6. Deep red and gray. 7. Maroon and warm green. 8. Deep blue and pink. 9. Chocolate and pea green. 10. Maroon and deep blue. 11. Claret and buff. 12. Black and warm green.

The Great Telescope.

An opportunity to see the largest refracting telescope in the world, which was afforded the public recently by the manufacturers, Warner & Swasey, was improved by a multitude. A constant procession of carriages and pedestrians moved to the works during the afternoon and evening and viewed the immense telescope with wonder and delight. The instrument will be dismounted within a few days and shipped to the Lick Observatory, Mt. Hamilton, Cal. The manufactory has been the Mecca for astronomers from all parts of the country for several weeks, and the visitors yesterday, comprising the leading scientific and business citizens of Cleveland and vicinity, were eager to improve the opportunity to see the great instrument. The column which supports all the movable parts is as high as a three story building. It is of cast iron, ten by seventeen feet at the base and four by eight feet at the top, and weighs 36,000 pounds. Surmounting this column is the head, weighing 8,000 pounds, in which turns the steel polar axis, ten feet long and twelve inches in diameter, weighing 2,800 pounds. When the instrument is placed in position in the observatory, this axis will be adjusted parallel to the axis of the earth, and consequently will point to the exact north pole of the heavens, around which all stars seem to revolve. At the upper end of the polar axis and at right angle to it is fastened a heavy cylinder or sleeve, which forms bearings for the steel declination axis. This axis is ten feet long and ten inches in diameter, weighing 2,300 pounds. Attached to the declination axis is the great steel tube, at the end of which will be placed the world renowned thirty-six inch object glass. The object glass, weighing with its cell 638 pounds, is now at the observatory on Mount Hamilton. This great lens, which is nearly 50 per cent more powerful than any other yet made, will gather the light from stars millions of miles away and concentrate it at the eye end of the tube, 56 feet 6 inches distant, where the brilliant image of the star is magnified by eye pieces or microscopes and observed by the astronomer. A great variety of eye pieces are provided, magnifying from 180 to 4,000 diameters. This eye end of the telescope is a marvel of intricate mechanical construction. It seems to be a series of telescopes within telescopes and wheels within wheels. In fact, there are five complete telescopes here besides the large one. Two of these, with object glasses six inches and four inches diameter, are in themselves as powerful telescopes as many in use in colleges. These serve as finders, to aid in pointing the great tube to the star desired. The other three small telescopes are for reading the fine graduations on the right ascension and declination circles located on the polar and declination axis. These circles are illuminated by electric light, and the readings give the exact position of the observed star to a single second.

Within reach of the astronomer while making his observations are a dozen wheels and handles, by which he can adjust the telescope so as to bring the star in the exact center of the field of vision. The tube is four feet in diameter at the center, tapering toward each end to thirty-eight inches. It weighs with all its attachments 8,600 pounds, and it is so nicely balanced on anti-friction bearings that it can be directed to any point in the heavens by a light pressure from one finger. All the motions, adjustments, and readings here described as being made by the astronomer in his position at the eye end of the instrument are also made by an assistant at his station on the balcony which surrounds the head of the telescope.

To enable the assistant to direct the instrument to any star, he is provided with a system of wheels and reading telescopes, so that he can do his work without even looking at the star. But even this is not considered sufficient, for just beneath the telescope head and within the upper section of the column is a powerful driving clock, governed by a double conical pendulum and regulated by electric connection with the standard sidereal clock of the observatory. The pendulum balls weigh 125 pounds and make one revolution per second. By an ingenious system of mechanism the driving clock is so connected with the polar axis of the telescope that the great tube when pointed to a star is made to move backward as fast as the earth moves forward in its diurnal motion, this counteracting the motion of the earth and making the star appear to stand still in the center of the field of the telescope. Access to the driving clock and balcony is gained by a spiral staircase at the south side of the column. The center of motion of the instrument is thirty-seven feet above its base. When the telescope is pointed to the zenith, the objective glass will be sixty-five feet above the base. The whole telescope complete weighs 65,000 pounds. So perfect are the details of its construction, many of them being invented by the manufacturers, that the colossal instrument can be used more conveniently and rapidly than many smaller instruments.

A telescope of such size is especially suited for such work as stellar photography and spectroscopy, because it collects so large an amount of light. The instrument will be mainly devoted to investigation in these two directions. Now, the photographing of faint stars requires an exposure of a sensitive plate for a long time, even for hours. During this time the image of the star on the photograph plate must remain absolutely at the same point. Hence the utmost care and pains were required to make so enormous a mass move accurately, neither faster nor slower than the earth on its axis.—*Chicago Leader.*

Railway Ties.

Among the interesting questions which are brought out in Mr. Dudley's dynagraph inspections, some of the most important have been those relating to the life of ties. He has observed that on the Old Colony and on the Boston & Maine, although the road looks in better surface than where chestnut or oak ties are used, it does not take so good a diagram. The cedar ties with which these roads are largely laid are so much softer than oak or chestnut that when an inequality exists it extends over a longer portion of the rail. Thus the bends in the rails are longer, which is better for the rails, but the surface of the rails is not so good; and when a point begins to get low, it not only wears into the tie faster on account of its greater softness, but it begins to cut into adjoining ties, which are not firm enough to resist the additional strain a low tie next to a high one produces. It would therefore seem to be a question not yet conclusively settled whether cedar ties are so economical as their greater durability would seem to imply. The greater amount of labor required to keep the surface in good condition, or the greater cost of hauling freight over the track when it is not so, may in the end balance the supposed gain in using a wood which does not decay quickly, but is very soft.—*Railroad Gazette.*

A Message from the Sea.

According to information received at Lloyd's from the Governor of South Australia, dated the 22d ult., a dead albatross has been found on the shore at Fremantle, and attached to its neck was a piece of tin, on which the following was written in French: "Thirteen shipwrecked persons are on the Crozet Islands, 4th August, 1887." The vessel to which these shipwrecked persons belonged is supposed to be the Tamaris, bound from Bordeaux for Noumea, which vessel was posted at Lloyd's as missing on the 31st of August, and the crew of which was composed of 13 men.

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ENGINEERING INVENTIONS.

A boiler flue has been patented by Mr. David Purves, of Ferro Dene, Green Lane, North Dulwich, Surrey County, England. The plate is formed with thickened bands on one side and channels on the opposite side, the thickened bands being rolled into stiffened ribs, making a boiler flue with a band or rib formed integrally therewith.

A car coupling has been patented by Mr. Jonathan H. Davis, of Natchez, Miss. The drawhead has a central chamber, with latches pivoted each side the link opening, having engaging curved arms, in connection with a spring-actuated pawl, and other novel features, making a coupler with which cars can be readily coupled upon a curve or with an opposing coupler of unequal height.

A car frame has been patented by Mr. Peter Matthews, of Escanaba, Mich. This invention relates to locomotive tender frames, and provides a construction designed to effectively resist longitudinal transverse strains of both tension and concussion, while the timbers will be strongly jointed without having to mortise or cut away the main longitudinal timbers of the frame.

A submarine excavator has been patented by Messrs. John and Peter Wagner, of Atchison, Kansas. The buckets are made to be used inside of a cylinder, and to be hung in such manner that they may be reversed upon their hinges to present either a plane edge or a toothed edge to penetrate the material to be excavated, the invention also providing a simple construction and combination of parts for opening and closing the buckets.

AGRICULTURAL INVENTIONS.

A corn planter and check rower has been patented by Messrs. John W. McMahan and Edwin S. Whittemore, of Huntingdale, Mo. This invention covers a novel construction and arrangement of various parts and details designed to afford a machine that will be simple and durable and very effective in operation.

A grain separator has been patented by Mr. William C. Buchanan, of Belleville, Ill. The construction is such that the rake or picker fingers are advanced at different rates of speed through paths of different length, so that the straw and grain acted upon are more fully torn apart, the invention being an improvement on a former patented invention of the same inventor and another.

MISCELLANEOUS INVENTIONS.

A top prop has been patented by Mr. William R. Moore, of Unionville, Pa. This invention provides an improved means for securing the bow iron to the seat iron or top prop stud, to provide an anti-prop rattler for carriages and top buggies.

A pocket hand brush has been patented by Mr. Charles B. Schroeder, of Brooklyn, N. Y. It consists of a hollow case provided with a silk hat pad or pads, and two brushes of different styles sliding in opposite ends of the case, making a compact and portable combined clothes and hat brush.

A fly screen has been patented by Mr. Julius Neifing, of Crown Point, Ind. It is for a window or other opening of a room, and is of such construction that the screen serves to exclude flies from entering an apartment, while also providing for the exit of any that may be in the room.

A dumping wagon has been patented by Mr. Thomas Hill, of Jersey City, N. J. This invention relates to carts or wagons for common road use, having shafts to adapt them to horse or cattle draught, and the bodies supported by side pivots or journals for tilting them, the invention covering various novel features of construction and combinations of parts.

A sewerage system for buildings has been patented by Mr. Charles H. Shepherd, of New York City. This invention relates to devices for securing the ventilation of the sewerage receiver, and to electro-magnetic appliances for releasing the discharge valve of the sewer pipe, covering various novel features of construction and arrangement of parts.

A composition for mineral wool has been patented by Mr. Richard D. A. Parrott, of Greenwood Iron Works, N. Y. It consists of one-third feldspar and two-thirds lime, combined by fusion and discharged in a small stream from a furnace, when it is subjected to a jet of steam or compressed air to blow it out into a fibrous mass.

A binder has been patented by Mr. Nehemiah Hawkins, of Brooklyn, N. Y. Combined with a pair of apertured covers and a binding cord is a flexible, transversely slotted back and retaining strips formed with projections through which the binding cord passes, with other novel features, making a ready binder for manuscripts, newspapers, sheet music, etc.

A machine for ironing linen fabrics or other materials has been patented by Mr. Henri C. Chasles, of Paris, France. Combined with a chamber which has perforations in its polished ironing side, this side working in silding contact with the fabric to be ironed, is a vacuum-producing device connected with the chamber, whereby vapor is removed and the fabric left completely dry.

A car bell has been patented by Mr. William H. Hudson, of New York City. This invention covers a novel combination and arrangement of parts, whereby the car bell may be rung by pressing upon a foot piece in the platform, the ringing being stopped when the pressure is removed, and the invention is an improvement on a former patented invention of the same inventor.

A circular sawing machine has been patented by Mr. David Arkin, of Manistee, Mich. This invention relates to the construction and arrangement of the carriage of a shingle-jointing machine, and also to the arrangement of a novel system of safety attachments or guards to protect the sawyer, the invention covering certain novel constructions and combinations of parts.

A tube expander has been patented by Messrs. Jacob Nebergall and Charles E. Schofield, of Waller, Ohio. Combined with a slotted tapering plug are two oppositely arranged jaws having projections for forming a bead in the tube inside of the tube sheet, and for turning the flange on the end of the tube outside of the tube sheet, with a cam lever for simultaneously operating the two jaws.

A combination tool has been patented by Mr. William H. Mitchell, of Horse Cave, Ky. It is an implement combining in itself a monkey wrench and pipe cutter and tongs, designed to be adapted for use upon varying sizes of pipe and fittings, and which may be changed from tongs to cutter or cutter to tongs, while not being any more bulky than either of the single implements it takes the place of.

A folding paper box has been patented by Mr. Joseph T. Craw, of Jersey City, N. J. The box body consists of an inner part creased and folded to form the bottom, side, and ends, with a rib about the bottom, and a frame constituting the outer walls and paste flap, the invention being more especially applicable in making shallow paper boxes, of which the blanks may be stored in small space.

A hair curler has been patented by Mr. John T. Stansbury, of Elkhart, Ind. A heating iron or core is combined with an outer curling shell which has means for taking hold of the hair, and is adapted to revolve, a spring being so arranged that the curling shell may be wound up and held under tension, and when the spring is liberated the shell will revolve and automatically curl the hair.

A washing machine has been patented by Messrs. John P. Caldwell and Joseph C. Wolfe, of Gainesville, Ga. This invention provides for rapidly operating a pounder in a suitable tub containing the washing fluid and clothes, and at the same time causing a rapid circulation of air through the contents of the tub, while the driving power may also be utilized to operate the dasher of a churn or do other similar work.

A pistol or mace holder has been patented by Mr. James P. Wintz, of Charleston, West Va. This invention covers an attachment to a belt consisting of a support and clip, one end of the latter being spring-actuated, and curved to fit a police club, pistol, or other article, the arrangement being such that the object secured can be removed laterally as well as in the ordinary manner, or it can be pushed back at the handle end and thus freed from its support.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER NUMBER.

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3. Page Engraving of Holbrook Hall, New York C ty, an Eight Story Apartment House, lately condemned for dry rot.
4. Plans for a School House costing between Eight and Nine Thousand Dollars.
5. Half page Engraving of a Residence at Battenhall Park, Worcester, England.
6. Perspective view, with floor plans, of a Dwelling costing Four Thousand Five Hundred Dollars.
7. Drawing of a Reception Pavil on, Geneva.
8. Illustration of the New Railroad Men's House, New York. A Club House costing One Hundred Thousand Dollars.
9. Design of an Attractive Residence at Minneapolis, Minn.
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11. Engraving of a Two Story and Attic House erected at Montclair, N. J., with floor plans. Cost, Thirty-seven Hundred Dollars.
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14. Design for an Entrance. Half page engraving.
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The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interest ng examples of Modern Architectural Construction and allied subjects.

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Special.

THE HEROISM OF WOMEN.

The number is legion who are chronic invalids, and are extremely puzzled to tell what ails them. They are miserable, extremely miserable. Especially may this be said of a very large class of females. They have a heavy, weighty feeling, as if being dragged to the earth; a misery in their back; an all-gone feeling. Scarcely able to put one foot before another, and yet seeing the work must be done, they go on, a tread-mill life from early morn till late at night, keeping about from the mere force of will. Arising is the morning but little refreshed by the few hours of broken sleep; no one but themselves knowing that incessant aches and pains had robbed them of that much needed rest.

The following is a brief statement taken from one of many letters received of similar import:

"CULPEPER, Va., May 31, 1886.

"DRS. STARKEY & PALEN: I wrote you my symptoms one year ago last February, when I was taking the Compound Oxygen, then given me by a friend, but I was so very weak and nervous at that time I doubt if it was sufficiently legible.

"My doctor treated me for catarrhal consumption, and gave me all kinds of medicines for suppression, but they only seemed to increase my pain. At last he concluded there was some organic derangement, and gave me surgical treatment, which instead of relieving me, increased my agony, producing inflammation that reached the brain, making me utterly sleepless and delirious for months.

"One day a friend came to see me who had a part of a Home Treatment of Compound Oxygen at her house, and persuaded me to try it. She sent it to me, and I commenced using it, but I must say with very little faith. After using it about a week my nose bled very profusely, and I felt great relief from the brain pressure that had kept me crazed for months. I began to sleep. My mind came back to me, though my doctor had said if I ever got better, or lived, I would never recover my mind. He seemed surprised that I had. He recommended surgical treatment, but I had suffered so much by that from him I would not trust it again. This was about a year ago, and I was an invalid until a month or so since, when I commenced to drag around a little, becoming so tired I could not rest. But since using Compound Oxygen I can rest and walk about, and the cold I had when the Compound Oxygen arrived soon disappeared. I am stronger and better than for years. Have resumed my old Sunday-school class, and played on the organ last Sunday."

There are very many people interested in the treatment which has done so much for this lady in Virginia. If you wish fuller information, send to Drs. Starkey & Palen, 1529 Arch Street, Philadelphia, Pa., for their treatise, which is sent free.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Sale—A $50.00 lathe, with extra attachments, for $30.00. B. Mitchell, 301½ Second St., Jersey City, N. J.

Twenty per cent saving and a large increase of steam supply.
U. S. Rocking Grate Bar Co., Chicago.

A good agency wanted, mechanical or process. Muller & Sieghortner, 319 Broadway, room 10, New York.

Drawings for machinery and factories, including buildings. J. H. Muller, Mech. and Civ. Engineer, 319 Broadway, room 10, New York.

Telegraph instruments cheap. W.E. Lewis, Corry, Pa.

Wanted—New invention or novelty for the English market by a first-class London house, having a large connection among shippers, warehousemen, drapers, etc. Address "Everclean," 100 Wood St., London, England.

Lacquers.—Japan, Brilliantine, Brassoline, Opaline, and other lacquers and special varnishes. *Brilliant, hard, durable.* Send for catalogue. The Fred'k Cram Chemical Co., Short Hills, N. J. N. Y. agent, Horace Van Sands, 733 Broadway.

Lathes for cutting irregular forms a specialty. See ad. p. 285.

For the best and cheapest 4 Horse Engine, address Peter Walrath, Chittenango, N. Y.

Perforated metals of all kinds for all purposes. The Robert Aitchison Perforated Metal Co., Chicago, Ill.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

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Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

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The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Curtis Pressure Regulator and Steam Trap. See p. 301.

Power, 113 Liberty St., N.Y. $1 per yr. Samples free.

Gardner & Miller's Patent Belt Clamps, 8 sizes. Billings & Spencer Co., Hartford, Conn.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

For best leather belting and lace leather, including Hercules, see Page Belting Co.'s adv.. p. 318.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 and 421 East 8th Street, New York.

Cushman's Chucks can be found in stock in all large cities. Send for catalogue. Cushman Chuck Co., Hartford, Conn.

Hoisting Engines. D. Frisbie & Co., New York city.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

Graphite Lubricating Co., Jersey City, N. J. Graphite bushings and bearings, requiring no grease or oil.

Quints' patent automatic steam engine governor. Correspondence solicited from manufacturers of throttle governor engines. Leonard & McCoy, 118 Liberty Street, New York.

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A clergyman, after years of suffering from that loathsome disease, catarrh, and vainly trying every known remedy, at last found a prescription which completely cured and saved him from death. Any sufferer from this dreadful disease sending a self-addressed stamped envelope to Prof. J. A. Lawrence, 212 East 9th St., New York, will receive the recipe free of charge.

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November 1, 1887,

AND EACH BEARING THAT DATE.

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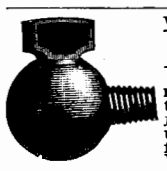

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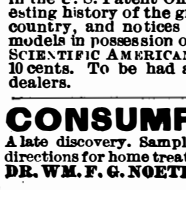

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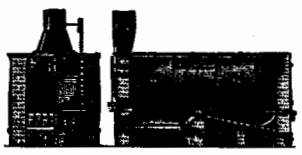

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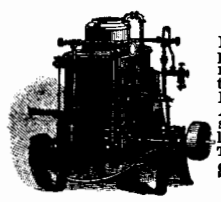

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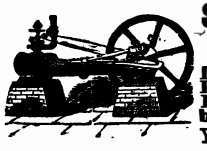

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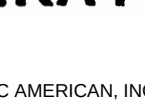

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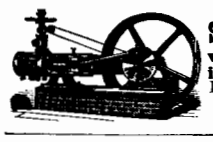

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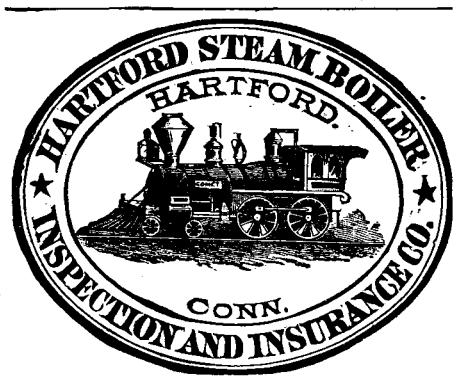

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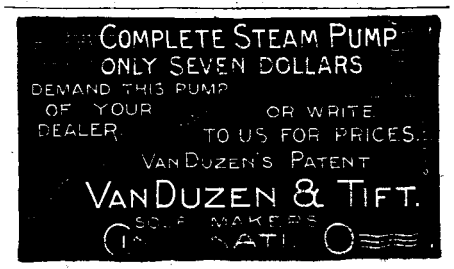

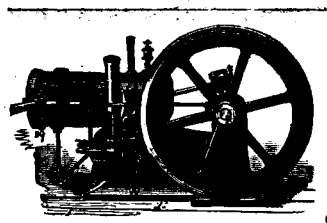

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